VOLUME 20 NUMBER 3

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VOLUME 20 SEPTEMBER 1934 NUMBER 3

MALIGNANT DISEASE OF THE LARYNX

RARE TYPES, PREMALIGNANT CONDITIONS AND CONDITIONS SIMULATING MALIGNANCY

JOHN EDMUND MACKENTY, M.D.†
EDITED BY E. ROSS FAULKNER, M.D.
NEW YORK

It is not uncommon for apparently benign conditions in the larynx eventually to become malignant. I use the word malignant to cover all types of sarcoma and carcinoma in their varied manifestations, and the apparently benign growths which eventuate in malignant processes. These, I am inclined to believe, are malignant from the start, the phenomena of frank malignancy being held in leash by some biologic factor yet unknown. Dr. Jackson speaks of them as premalignant or precancerous—an excellent definition. My clinical experience in watching many apparently benign conditions progress slowly, at times very slowly, to frankly malignant conditions suggests that they may be more than premalignant and that somewhere in the structure, concealed from the physical eye, malignant changes are active long before they become manifest, even from the start. In other words, premalignancy may mean the initial stage of malignancy and a true part of it.

Years ago, I witnessed a strange phenomenon in this regard. A melanotic sarcoma, recurrent after removal, had progressed to involvement of the glands of both axillae, both sides of the neck and both groins. These metastatic masses ceased to grow for five years, and then melanotic sarcoma killed the patient within six weeks by attacking the liver. The disease was in leash for five years. It is conceivable that a malignant intent on the part of an apparently benign growth, such as that mentioned, might be restrained more easily at its inception by some biologic process than could a melanotic sarcoma during its active career.

That malignant disease has a systemic background is suggested by its occurrence at widely separated periods and in widely separated locations in the same person. In one of my patients a cancer was removed from the lip. Six years later he died of sarcoma of the liver. In another patient a cancer of the lip was removed; the condition reappeared several

† Dr. John Edmund MacKenty died on Dec. 11, 1931.

Read before the Clinical Congress of the American College of Surgeons, Philadelphia, Oct. 16, 1930.

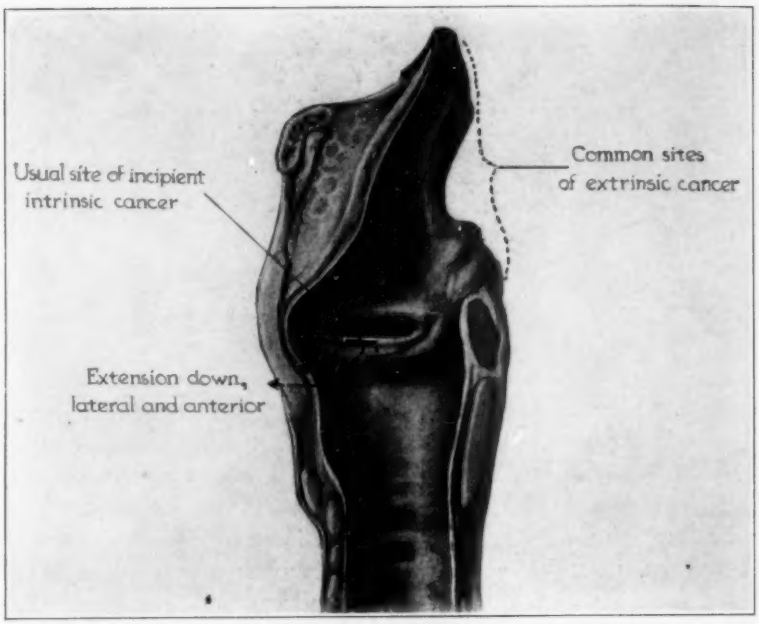

Fig. 1.—Usual site of incipient intrinsic cancer, with extension down, laterally and anteriorly, and the common sites of extrinsic cancer.

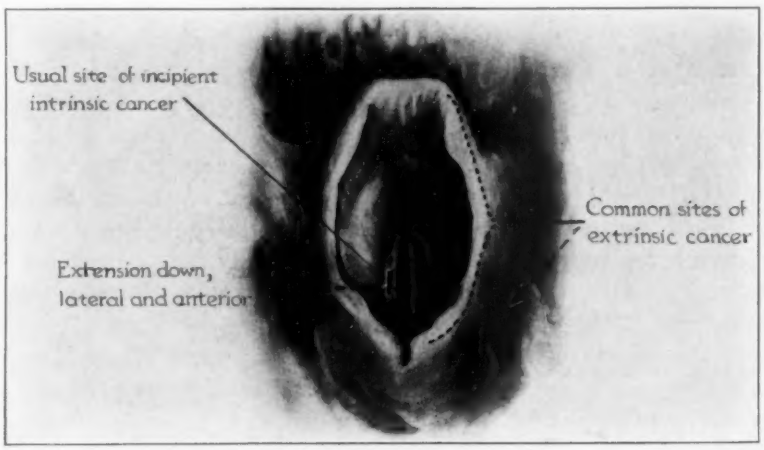

Fig. 2.—Usual site of incipient intrinsic cancer, with extension down, laterally and anteriorly, and the common sites of extrinsic cancer.

Fig. 3.—Beginning malignant disease of the left vocal cord.

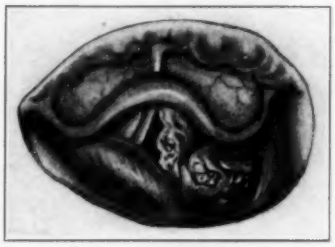

Fig. 4.—Extrinsic carcinoma which started as an intrinsic growth on the left vocal cord.

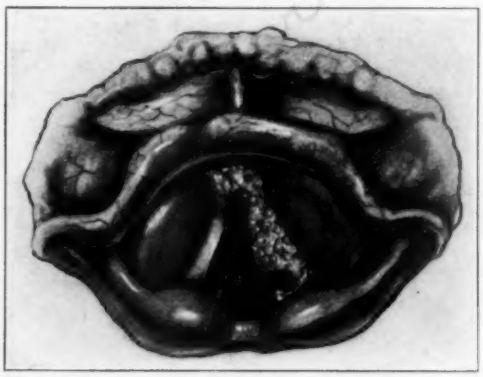

Fig. 5.—Extensive intrinsic epithelioma.

Fig. 6.—Subglottic cancer of the larynx.

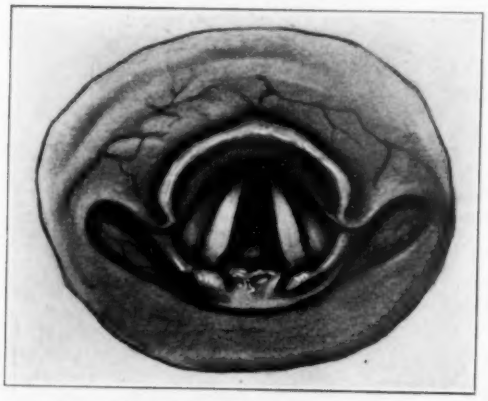

Fig. 7.—Early tuberculous laryngitis.

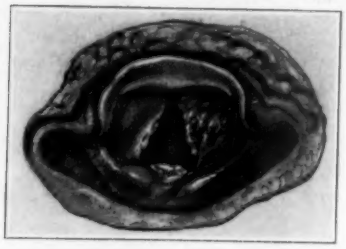

Fig. 8.—Late tuberculosis of the larynx.

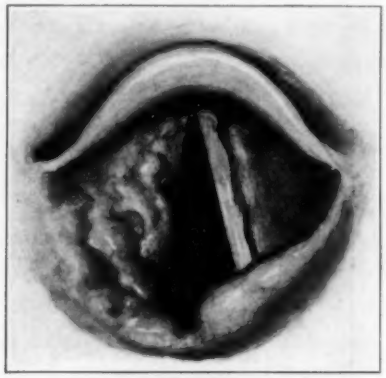

Fig. 9.—Tuberculosis involving the right ventricular band.

Fig. 10.—Syphilis of the larynx, with hypertrophic infiltration of the entire larynx and epiglottis and perichondritis.

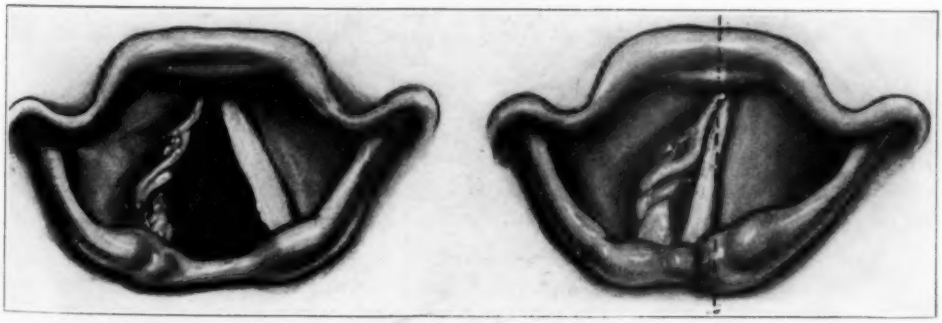

Fig. 11.—Syphilis of the larynx, with fixation of the affected vocal cord, simulating cancer. The dotted line indicates the normal position.

years later in the larynx. In one patient, a malignant growth appeared in the soft palate two years after removal of the larynx for cancer. Another patient survived total laryngectomy and double block

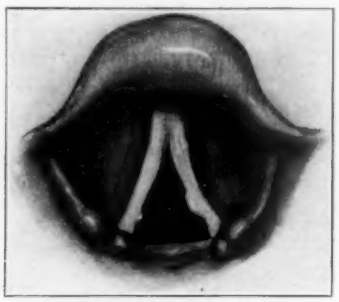

Fig. 12.—Cicatricial stenosis of the larynx (syphilis).

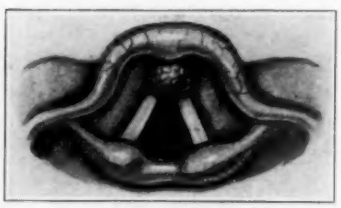

Fig. 13.—Papilloma of the larynx in the anterior commissure.

Fig. 14.—Pedunculated papilloma of a vocal cord.

dissection of the neck, to reappear seventeen years later with a recurrence of the growth in the neck. Severe infection of the jaw from abscessed teeth developed, with acute suppurative cervical adenitis. The condition of the mouth cleared up, but the glandular swellings in the neck failed to recede, owing to an acutely active carcinoma. I believe that cancer cells lay dormant all those years in these glands until stimu-

lated into activity by the acute infection. One should never assert that cancer is cured. It is more in keeping with the evidence to say that it is arrested.

CANCER IN THE YOUNG AND IN THE AGED

For many years it was believed that the young and the very old were immune from cancer of the larynx. The experiences of physicians who see much of this disease disprove this belief and indicate that one should be alert for signs of its appearance in the very young, the fairly young and the very old. In my own records cancer of the larynx occurred in five patients under 30 years of age, four of whom were women. One was just under 30, one was 29 (a man), one 26, one 24 and one 20.

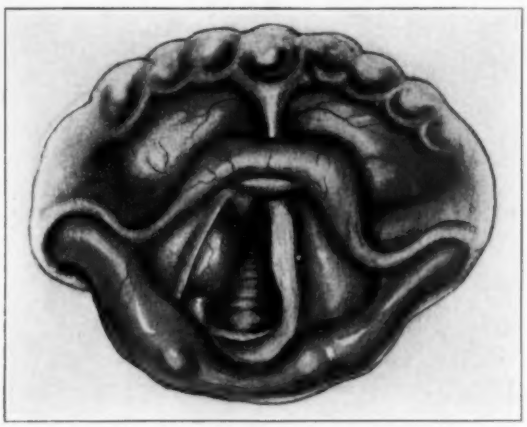

Fig. 15.—Soft fibroma in Morgagni's ventricle.

The disease showed unusual rapidity of growth in all. The woman, aged 20, had a basal cell carcinoma, which, owing either to the application of roentgen rays or to the malignant nature of the disease, grew with fulminating rapidity. A woman, aged 30, had a small anterior growth, which was entirely removed for biopsy. So malignant was the microscopic appearance of the specimen that Dr. Jackson, Dr. Chamberlain and Dr. Pitkin all agreed that total laryngectomy was indicated.

Three of these patients were operated on and were free from recurrence for four, three and one year, respectively. The patient who was free from recurrence for three years (20 years old) had fairly extensive involvement, owing to the delay of three months in the application of roentgen rays. These were not applied on my advice. In the man, 29 years of age, the entire right half of the larynx was involved, notwithstanding the fact that symptoms had been present for only three months.

The two patients who refused to be operated on, aged 26 and 24 years, respectively, had intrinsic cancers of a moderate degree of malignancy. One subsequently died on the operating table in Boston while undergoing thyrotomy. The other died of cancer nine months after its

Fig. 16.—Subglottic fibroma of the larynx.

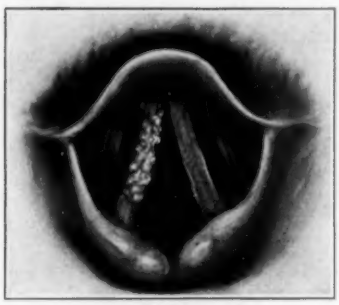

Fig. 17.—Keratotic disease of a vocal cord.

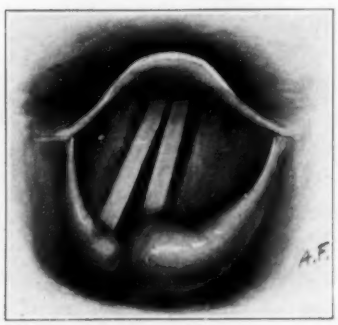

Fig. 18.—Cyst of an arytenoid cartilage.

inception. These observations support the belief that cancer in the young is highly malignant.

It is the opinion of several observers, as well as mine, that laryngeal cancer in the young is more common in women than in men, the reverse of the ratio in later life. St. Clair Thomson reported cancer in a man,

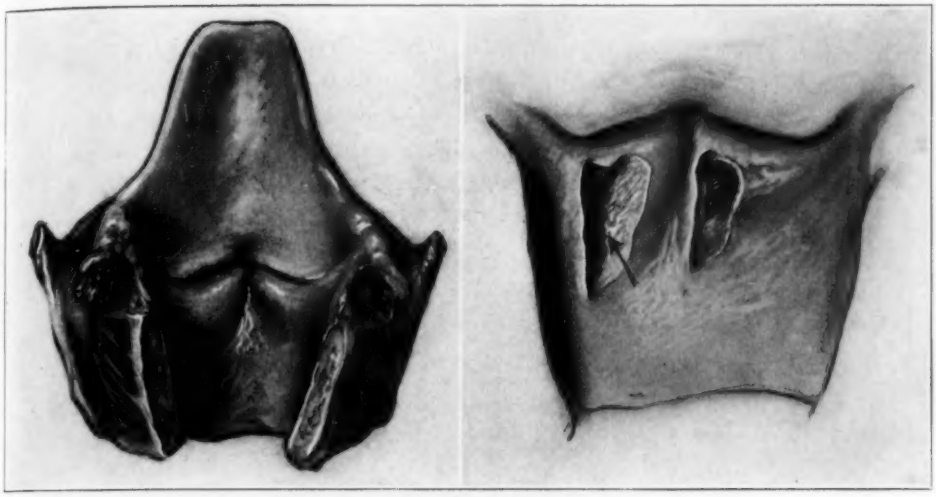

Fig. 19.—Subglottic carcinoma of the larynx in C. S., a man, aged 84.

Fig. 20.—Carcinoma of the larynx involving the anterior commissure in E. M., a man, aged 81.

23 years old, Chiari in a girl, 16 years old. New, in 1929, reported two cases, one in a woman, aged 24, the other in a boy, aged 15.

Laryngeal cancer in the young is liable to be mistaken for one of the infectious granulomas or for a benign neoplasm. In all the patients of this class who were seen by me there had been antecedent pathologic changes in the larynx, which still further masked the diagnosis. The following must be excluded in differential diagnoses: tuberculosis, syphilis, chronic laryngitis, papilloma, angioma, fibroma, tuberculoma, rhinoscleroma, blastomycosis, hyperkeratosis, pachydermia laryngis, prolapse of the ventricle and paralysis. In doubtful laryngeal growths

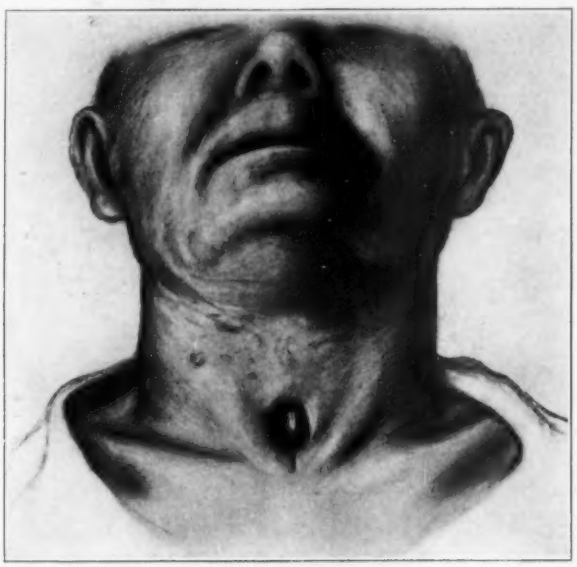

Fig. 21.—View of neck of the same patient as in figure 20.

in the young, biopsy should not be delayed, provided that tuberculosis can be excluded. Biopsy in tuberculosis of the larynx is, I believe, a serious error. Six patients in my series, aged 80 years or more, underwent laryngectomy. Three survived the operation (figs. 19, 20 and 21).

SARCOMA

Sarcoma is rare in the larynx. Only one proved case appears in my records. Its attack on the larynx is usually deep-seated and masked. It may resemble slow chondritis, with displacement inward of the intralaryngeal structures without marring or alteration of their surfaces. The characteristic appearance of malignant disease, typical in squamous cell cancer, is wanting until late, when the growth bursts through the mucous membrane.

CASE 1.—W. G. U., a man, aged 45, consulted me in November, 1920, because of intermittent hoarseness for nine years and continuous hoarseness for sixteen months beginning with a severe attack of tonsillitis, rheumatism and autointoxication. The tonsils were badly infected. The Wassermann reaction was two plus. Examination showed immobility of the left vocal cord, edema of the left arytenoid cartilage, thickening of the laryngeal wall on the left and partial loss of mobility of the right vocal cord. There was neither pain nor dysphagia. External examination revealed a suggestion of thickening of the left wall of the thyroid cartilage. Under antisyphilitic treatment there were some improvement in mobility and a diminution of the general thickening.

Tonsillectomy was performed three months after the patient was first seen. One month later, a subglottic, smooth, rounded swelling appeared on the left side, the precursor of acute chondritis of the left ala of the thyroid cartilage, with edema of the left vocal cord, exquisite tenderness and pain over the affected area, general malaise and a rise in the temperature.

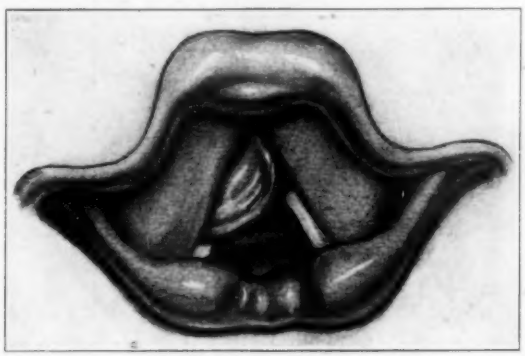

Fig. 22.—Apparent prolapse of Morgagni's ventricle (later diagnosed as cancer).

Disease of the lungs was excluded by Dr. James Alexander Miller. The suspicion of a malignant process (complicated by syphilis and infection) was so strong after a further two month period of observation that the entire larynx was removed.

Microscopic examination revealed marked edema and induration below the left vocal cord. The mucosa of the larynx was intact but very edematous, and in areas it showed cysts containing purulent fluid. Sections showed lymphosarcoma. Changes in the blood vessels suggesting syphilis and chronic inflammation were observed. The patient was still alive and well ten years later.

APPARENT PROLAPSE OF MORGAGNI'S VENTRICLE (LATER DIAGNOSED AS CANCER)

Eversion or prolapse of the ventricle eventuated in cancer twice in my experience. Both patients gave a history of syphilis, and the occupation of both demanded excessive use of the voice.

ACROMEGALY

Dr. Jackson called attention in 1918 to acromegaly of the larynx. I wish to mention one such case.

CASE 2.—S. G., a man, aged 63, presented an advanced type of acromegaly of the larynx, which he had had since the age of 20. Progress was arrested for many years. The voice was rough, deep and hoarse. Externally, the larynx was somewhat enlarged and asymmetrical, the left side being larger than the right. The vocal cords and arytenoid cartilages were thickened, being thicker on the left than on the right. The left cord was less active than the right. Both cords met on phonation. On deep breathing they stayed almost closed (bilateral paresis of the abductor). Breathing was unhampered, except on exertion, when the patient became dyspneic. To the uncritical eye, this case resembles cancer somewhat.

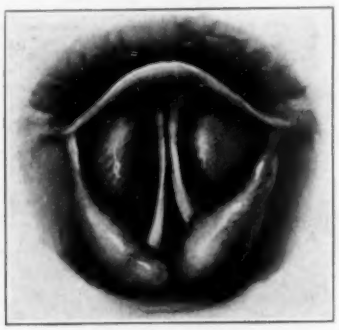

Fig. 23.—Acromegaly of the larynx in S. G., a man, aged 63.

CHONDRITIS OF THE THYROID CARTILAGE EVENTUATING IN CANCER

CASE 3.—A. P., a man, aged 35, came to the clinic in 1926 because of hoarseness, which had existed for twenty years. The mucous membrane of the larynx was uniformly red, and the false vocal cords were thickened; the Wassermann test and examination of the chest gave negative results. The tonsils were badly diseased, and tonsillectomy was performed. Twelve days after tonsillectomy it was necessary to do an emergency tracheotomy for laryngeal edema. The edema subsided within a short time, leaving the vocal cords fixed in the position of bilateral abductor paralysis. Twelve weeks later, a pretracheal abscess was opened, and symptoms of chondritis, affecting the entire thyroid cartilage, developed. Other abscesses formed and were opened. The laryngeal lumen became completely closed. One year later, Dr. Wilson, the surgeon in charge of my clinic, made an effort to remove the diseased cartilage, with little success. The suppurative process continued for three years, abscesses forming and fistulas appearing on the neck.

In June, 1929, laryngectomy was performed. Before the operation malignancy was not suspected. We thought that we had to deal with chronic suppurative chondritis. When the neck was opened, we found on the right side an area which suggested either cancer or tuberculosis. Owing to some difficulty in the laboratory,

a frozen section could not be made. The entire larynx was removed, with the hope that the condition might be tuberculosis. Later examination proved it to be a low grade malignant process. The disease progressed slowly for a year and then became fulminating. The patient committed suicide in August, 1930. A sketch of the neck is shown (fig. 24).

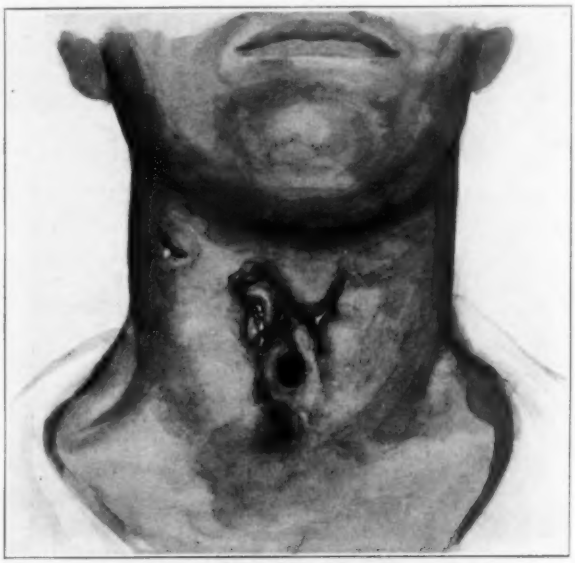

Fig. 24.—Drawing of the neck of A. P., a man, aged 35, in whom cancer recurred secondary to chondritis.

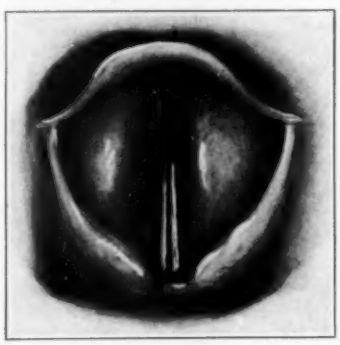

Fig. 25.—Chondritis of the larynx.

HYPERKERATOTIC PAPILLOMA, WITH EPITHELIOMA OF LOW DEGREE OF MALIGNANCY AND TUBERCULOSIS OF THE LUNGS

CASE 4.—H. S., a man, aged 48, had had hoarseness for seven years and productive cough for twenty years. Biopsy was performed at another hospital, and the condition was said to be squamous cell carcinoma. Examination of the larynx

was unsatisfactory, on account of traumatism from biopsy. Mobility was normal. On the the left vocal cord, anterior to the site of the biopsy tissue, were a few whitish, raised, cornified looking areas. Examination of the lungs, by Dr. J. A. Miller, showed extensive, inactive tuberculosis of the upper lobe on the left. The biopsy slides were sent to Dr. Francis Carter Wood, who reported: "Pachydermia laryngis; no indication on the sections of malignancy."

After the site of the biopsy tissue had healed, the larynx assumed the typical appearance of hyperkeratosis; i. e., the mucous membrane over the cord was thickened and irregular and had a few small, warty-looking areas with yellowish crests. There was considerable improvement during the following summer. On Dec. 7, 1929, nearly one year after our first observation, there was no change. On Jan. 11, 1930, three weeks later, the cord was covered with an irregular, raised,

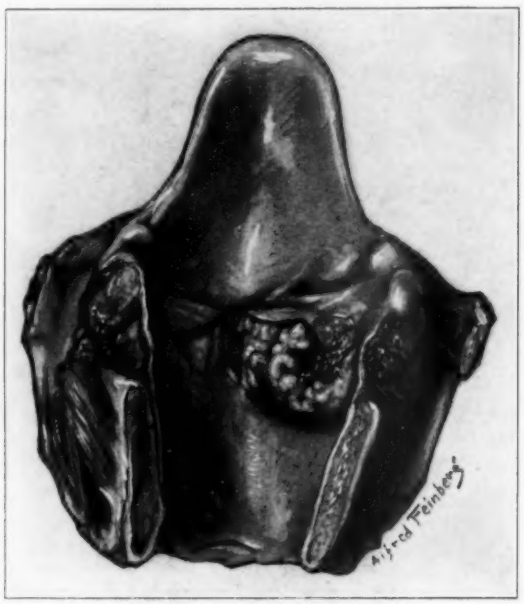

Fig. 26.—Hyperkeratotic papilloma, with epithelioma of a low degree of malignancy, in H. S., a man, aged 48.

warty-looking growth, which crossed the anterior commissure to the opposite side. Fixation was complete. Laryngectomy was performed. The laboratory report was: hyperkeratotic papilloma, with epithelioma of a low degree of malignancy.

SCLEROMA OF THE LARYNX, SCLEROMA RESPIRATORIUM OR RHINOSCLEROMA

Scleroma is a chronic, infectious granuloma; it was first recognized by Hebra, in 1870. Frisch later discovered the causative organism and gave it his name—Frisch's bacillus, also known as the bacillus of scleroma. The word scleroma is from the Greek, meaning hard swelling. Lesions show discrete, bluish-red, edematous nodules. They coalesce into large

masses and may ulcerate on traumatism. With age, the nodules become hard and grow lighter in color. They suggest sarcoma. Later still, scarring and atrophy appear. The disease is more common in females and usually begins in the anterior part of the nasal septum and spreads downward. In the larynx, it resembles an atypical malignant condition so closely that without its nasal manifestations or without biopsy diagnosis would be impossible.

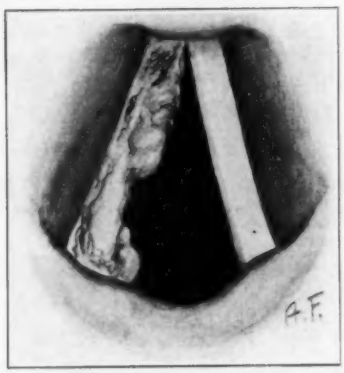

Fig. 27.—Scleroma of the larynx in H. P., a woman, aged 60.

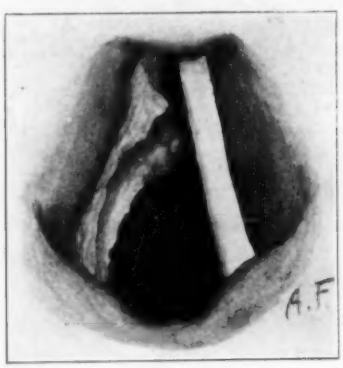

Fig. 28.—Same larynx as in figure 27, two years later, after roentgen treatment.

CASE 5.—H. P., a woman, aged 60, born in Russia, had rhinoscleroma of ten years' duration, increasing hoarseness of three months' duration and cough for two years, which was sometimes spasmodic and severe. The right vocal cord showed two conditions: an active proliferating area on the anterior half and a cicatrizing process on the posterior half. Mobility was somewhat impaired. Breathing was not obstructed. Biopsy revealed scleroma. A microscopic specimen was covered with stratified squamous epithelium infiltrated by polymorphonuclear leukocytes. There was no ulceration or epithelial hyperplasia suggesting malignancy. Mikulicz' cells, containing gram-negative encapsulated bacilli which morphologically

resembled the bacillus of rhinoscleroma, and Russell's fuchsin bodies were present. The diagnosis was scleroma. The condition improved materially under roentgen treatment.

CASE 6.—E. A., a woman, aged 47, born in Russia, had had active scleroma of the nose for eighteen years. Two years after the rhinoscleroma was discovered, Dr. X removed what he called a papilloma from the larynx. Edema followed immediately, and tracheotomy was performed. The patient wore the tubes for four and a half years. Radium treatment was also given. Great improvement followed, and the tube was removed later. Dilators were used. Obstruction increased for two years. On later examination, the larynx showed one mass of scleroma. About 1 inch (2.5 cm.) below the vocal cords was an area of active scleroma causing obstruction.

AMYLOID TUMORS OF THE LARYNX

Amyloidosis of the upper respiratory tract may be either local or part of a general amyloidosis. The true nature of this condition is

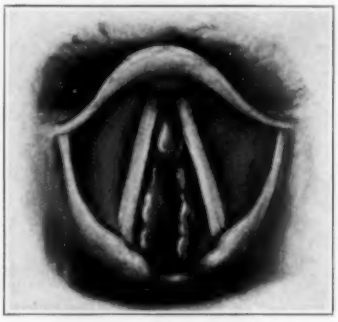

Fig. 29.—Amyloid tumor of the larynx.

uncertain. It is associated with chronic diseases, such as osteomyelitis, tuberculosis, syphilis and chronic suppurations in any part of the body. It has a predilection for the respiratory system and particularly for the larynx. Statistics gathered by New in 1919 showed that in thirty-three of forty-six cases of amyloid disease of the respiratory system the larynx was involved.

One theory is that it arises from local overproduction of chondroitin-sulphuric acid, which becomes bound with proteins in situ; this is more prone to occur in tissues subject to irritation, either inflammatory or neoplastic. It may resemble syphilis or cancer in its laryngeal manifestation. Growth is generally slow. There may be either no local symptoms or those due to obstruction. Multiple or single nodules appear, generally sessile, but at times pedunculated. These growths are usually round or oval, mamillated and firm; their color is waxy and yellowish gray and sometimes reddish. There is no ulceration. A rarer type

may show diffuse, uniform, subepithelial thickening of the entire larynx, extending to the trachea. Either type may produce obstruction and may be grafted on a preexisting growth, such as angioma, fibroid or even carcinoma. Hoarseness and, if obstruction occurs, dyspnea are the only symptoms.

Diagnosis is based on the presence of amyloid disease elsewhere, the exclusion of syphilis and tuberculosis and biopsy employing suitable stains (hematoxylin and eosin).

Treatment consists in surgical intervention, fulguration and the application of radium.

One case appears in my series.

BLASTOMYCOSIS OF THE LARYNX

Blastomycosis is considered a disease of the skin or a systemic disease; it is common in South America but rare here. It occurs in grain

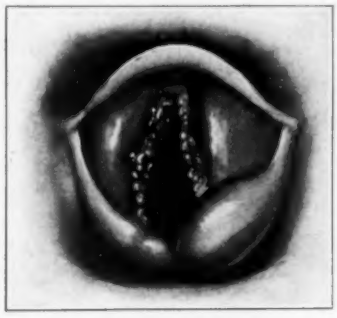

Fig. 30.—Blastomycosis of the larynx.

workers. It may involve the larynx and the lungs and, more rarely, the pharynx, tonsils, trachea and tongue. It has been mistaken for cancer. Its appearance in the larynx is also suggestive of tuberculosis, especially if the lungs are also involved. Then all the classic symptoms of tuberculosis may be present: emaciation, cough, sweats, etc. Laryngeal involvement varies with the extent of the disease. At first it resembles chronic inflammation; later there may be infiltration and ulceration. Nodules usually appear, and the mucous membrane looks as though it had been burned by a strong solution of silver nitrate. The diagnosis depends on the exclusion of tuberculosis, syphilis and cancer and on the finding of the causative organism, the blastomycete, a form of yeast fungus, which is pathogenic for man and animals. It is a spheroid or ovoid organism from 4 to 8 microns in diameter. The organism may be demonstrated in the sputum, in biopsy tissue and in cutaneous lesions after tracheotomy. In cases in which tracheotomy has been performed the organism attacks the skin, giving a characteristic

appearance. The symptoms are hoarseness, paroxysmal and severe cough, a burning and pricking sensation in the larynx, dyspnea, dysphagia, general debility and loss of weight and strength. Progress is slow, and the result is fatal unless treatment is instituted. Treatment consists in large doses of potassium iodide and the application of roentgen rays.

PEMPHIGUS

Primary pemphigus in the larynx must be extremely rare. Albert B. Murphy reported a case in 1929, in which the skin became involved later. When the larynx is involved, the disease is usually evident elsewhere. In two instances I have seen extensive laryngeal ulceration,

Fig. 31.—Blastomycosis of the skin around the tracheal opening.

which might have been confusing had not the true nature of the disease been known. The laryngologist may be primarily consulted, as the disease frequently makes its first appearance in the mouth and throat.

REPORT OF ADDITIONAL CASES

Further instances of the conditions already described and of some atypical conditions are reported.

EXTENSIVE SQUAMOUS CELL CARCINOMA OF THE LARYNX WITH RECURRENCE SIXTEEN YEARS LATER

CASE 7.—O. E., a man, aged 44, underwent laryngectomy for extensive squamous cancer of the larynx in October, 1915. The wound sloughed badly, necessitating an extensive plastic operation.

Prompt recurrence was expected. Sixteen years later, owing to a foul mouth and infected teeth, a severe phlegmon of the neck developed. This was opened and drained, but failed to heal. About two months later, the drainage openings in the neck took on a suspicious activity, which on microscopic examination proved to be fulminating and highly malignant squamous carcinoma.

Comment.—I believe that the neck was involved at the time of the original cancerous growth. For some unknown reason the cancer cells lay dormant until stimulated by the acute infection.

OBSCURE TUBERCULOSIS

CASE 8.—E. H., a woman, aged 31, presented a rare type of laryngeal tuberculosis, with negative findings in the lungs. She was referred to me by Dr.

Fig. 32.—Photograph of the excised larynx of O. E., a man, aged 44, showing extensive squamous cell carcinoma. Recurrence followed sixteen years later.

Harmon Smith in April, 1929. Two months prior to examination she began to have laryngeal soreness and dysphagia. These symptoms were progressive.

The patient was underweight and anemic. Examination of the larynx showed that both vocal cords were equally and symmetrically involved by a white, edematous, fusiform swelling, replacing the anterior two thirds of both cords and extending slightly up onto the base of the epiglottis. The posterior part of the larynx was clear, and there was no limitation of motion. The teeth were congenitally defective, badly erupted and imperfectly formed. Four secondary teeth had failed to erupt, their place being filled by the primary teeth. There had been no pregnancies. Syphilis was suspected on the first examination.

Report from Dr. Harmon Smith (April 26).—"Dr. J. A. Miller examined the lungs and found them negative for tuberculosis. Cultures and smears made from the throat were negative for tuberculosis and Vincent's angina. There was no history of tuberculosis in the family. The mother reports that the grandmother had cancer but lived to be 95. The great-grandfather and uncle died of cancer of the throat. The father died of a throat ailment, probably a thyroid condition.

The patient has lost weight. There is sensitivity to pressure on the right side of the larynx, where there is an enlarged cervical gland."

Report from Dr. Harmon Smith (May 29).—"In talking with Dr. Childers, I find that he has given three injections of arsphenamine and has treated this patient with mercury, but not with iodide of potassium. It appears to me that there have been some radical changes in the larynx, but whether for the better or not I am unable to determine."

Report on Biopsy (June 7).—The specimen consisted of several small fragments of tissue. Sections showed a slightly thickened and edematous mucosa with a definite limiting membrane. The submucosa showed marked mononuclear reaction and some irregular tubercle formation with several large multinucleated giant cells and small areas of caseous necrosis.

Report from Dr. Wood (June 13).—"The slides for the patient are perfectly characteristic of tuberculosis."

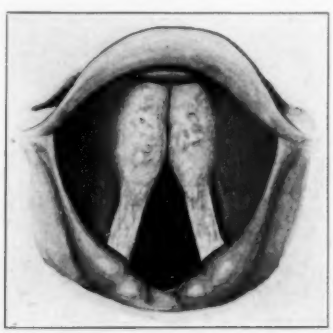

Fig. 33.—Rare type of laryngeal tuberculosis, with negative findings in the lungs, in a woman, aged 31.

EXTENSIVE CHONDROMA OF THE LARYNX

Case 9.—A. H., a man, aged 54, had hoarseness for five years, which had grown deeper shortly before examination. Laryngeal enlargement began two years before examination and had gradually increased. The patient had been dyspneic for two months. There was neither pain nor dysphagia.

Laryngeal examination showed the glottis displaced to the left and the larynx rotated 90 per cent on its long axis. The trachea lay on the left side of the neck over the area of the great vessels. The laryngeal lumen was obliterated by a rounded, irregular, grayish mass projecting into it from the right side. No ulceration was present.

Operation was difficult, on account of the dyspneic condition of the patient and the difficulty in locating and opening the trachea. The growth filled the neck to the sternal notch, leaving no room to reach the displaced trachea.

Laboratory Report (Jan. 20, 1931).—Macroscopically, the specimen consisted of a larynx with a tumor mass. The mass was ovoid and hard, with a nodular surface. It was attached to and involved practically the entire right thyroid cartilage, which it penetrated, and encroached markedly on the laryngeal cavity. The

right vocal cords and the ventricle were practically obliterated by the mass. The tumor measured 7 cm. laterally, 6 cm. anteroposteriorly and 4.5 cm. vertically. Gross section revealed a cartilaginous mass in which were many cystic cavities containing clear fluid. The entire specimen weighed 110 Gm.

Microscopically, numerous sections from the external portions of the tumor revealed a hyaline matrix surrounding areas and nests of cartilage cells. The matrix was extensive. The cells showed some activity, but this was not extensive. Both the cells and the matrix showed areas of liquefaction and necrosis. No active signs of infiltration or inflammation were noted. Sections of both vocal cords showed atrophy but no cellular proliferation. There were a few areas of inflammatory infiltration in the cord structures.

The diagnosis was chondroma.

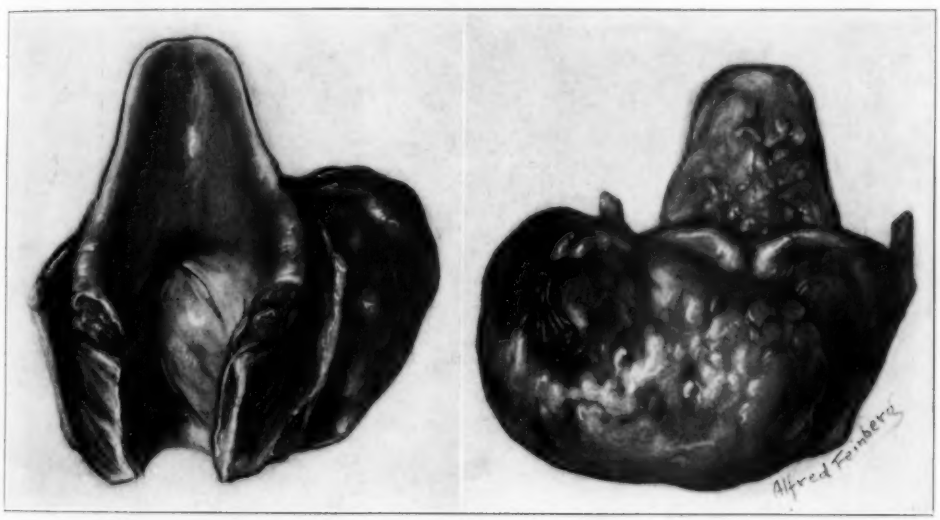

Fig. 34.—Extensive chondroma of the larynx in A. H., a man, aged 54.

MULTIPLE DIFFUSE HYPERKERATOTIC PAPILLOMA WITH PRECANCEROUS CHARACTERISTICS

CASE 10.—M. K., a man, aged 48, was referred to me on Jan. 27, 1930, because of a condition which had been diagnosed as well advanced laryngeal carcinoma. No biopsy had been performed. The patient gave a history of hoarseness for fifteen years, which had increased much during the last two years. He had no dysphagia, but dyspnea was present to an alarming extent. In one attack of severe asphyxia oxygen had to be administered in order to revive him.

The larynx presented an extraordinary picture. The entire structure was filled with a white hyperplastic mass, involving both sides equally, on the surface of which was a peculiar-looking, black, fuzzy, mossy growth, fungoid in appearance. There was no loss of mobility. This was a disturbing factor in making a diagnosis of malignancy in so extensive a condition, but whether or not the microscope would ultimately show actual malignancy the growth was malignant in its intent and would kill the patient if nothing were done, as it was almost entirely obstructive. There was little airway left. The tip of the epiglottis rotated to the left

on phonation. A few small, shotty glands were perceptible on the right side of the neck near the larynx.

Total laryngectomy was performed on February 19. The larynx was small. A congenital extension of Morgagni's ventricle to about within 2 inches (5 cm.) from the base of the tongue on the right side was found. The condition was interesting. The growth was apparently a papilloma or hyperkeratosis with beginning malignant changes at its base, as shown by the laboratory report.

Laboratory Report on Gland from Outside of Larynx (Feb. 19).—Macroscopically, the specimen consisted of a small irregular mass of thyroid and lymph gland.

Microscopically, sections showed thyroid gland with some increase in colloid in the acini and slight epithelial hyperplasia. The lymph gland showed simple diffuse hyperplasia, but no areas of tumor cells were noted.

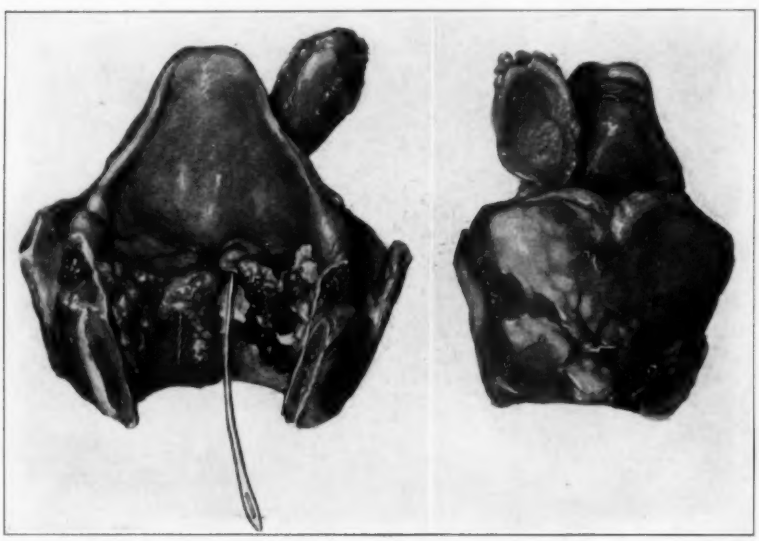

Fig. 35.—Hyperkeratotic papilloma, with beginning malignant change, in M. K., a man, aged 48, who had symptoms for fifteen years. Congenital sacculation (extension of Morgagni's ventricle was present).

The report was thyroid tissue and a hyperplastic lymph node.

Laboratory Report on Removed Larynx (March 26).—Macroscopically, the specimen consisted of the larynx and epiglottis. Posterior media section revealed a diffuse, sessile, firm, friable, grayish-white surface thickening of the mucosa. The surface was covered with friable warty excrescences. The mass involved the entire extent of both true cords and the aryepiglottic folds. Both false vocal cords and the base of the epiglottis were free from tumor tissue. On gross section the tumor did not appear to penetrate deeply.

Microscopically, a section showed excessive hyperkeratotic papillary hyperplastic stratified squamous epithelium. There was distinct orientation, and definite basement membrane was present in the majority of the papillae; however, in a few early cellular infiltration appeared. The adjacent stroma was dense and fibrous and showed marked mononuclear inflammatory reaction.

The diagnosis was multiple diffuse hyperkeratotic papilloma with some precancerous characteristics.

INTRINSIC BASAL CELL EPITHELIOMA OF THE LARYNX

CASE 11.—K. H., a young woman, aged 20, gave the following important points of her past history prior to the development of cancer: She was anemic and sickly as a child; had a great deal of trouble during childhood with inflamed glands of the neck and had many attacks of tonsillitis. She had had sinusitis since childhood. Hoarseness began in 1924, following acute laryngitis. It had been remittent ever since and had never been entirely absent. In November, 1926, the hoarseness deepened and became progressive.

On June 28, 1927, examination revealed chronic pansinusitis, badly infected tonsils, chronic laryngitis, neoplasm of the anterior half of the left vocal cord and no change in mobility. Biopsy was performed prior to my first examination, and the growth was reported as papillary cancer. This type is slow-growing and is not prone to invade the lymph glands. It is often mistaken for sarcoma. Large doses of roentgen rays were applied for more than three months.

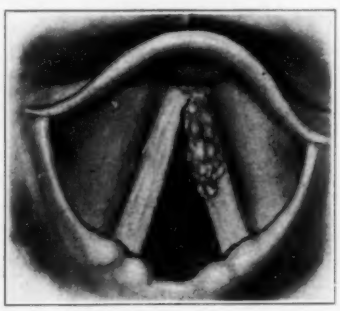

Fig. 36.—Larynx of K. H., a woman, aged 20, at time of first examination.

On October 4, the whole larynx was tender, enlarged, rounded out and bulbous; the anatomic outlines were blurred; the skin was tanned and thickened, and the subcutaneous tissues were adherent to the larynx. The larynx was filled with neoplasms on both sides; there were more on the left. The left arytenoid cartilage now seemed to be involved. The arytenoid cartilages were edematous. Breathing was obstructed. The patient was sent to Dr. Jackson for diagnosis of the condition of the hypopharynx and the esophageal mouth.

On October 6, Dr. Jackson reported: "This is an acute edematous laryngitis and chondritis, with fungations in the larynx. The anterior wall of the hypopharynx is extremely inflamed and edematous, but the mucous membrane is still intact." The operation was delayed until October 22, on account of the reaction following irradiation.

Operation and Recovery.—Operation was performed on October 22, with the patient under morphine-scopolamine hydrobromide and procaine hydrochloride-ether anesthesia. Dense adhesions were found binding the larynx to its surroundings. The thyroid gland was large, covering two thirds of the larynx. There was a fibrous mass surrounding the larynx, suggestive of cancer. Frozen sections, taken at several points during the operation, revealed nothing of importance. The larynx, epiglottis and about one half of the thyroid gland were removed. The skin

flaps were almost bloodless, and their immediate retraction at the time of operation made closure nearly impossible (the usual result of irradiation). The growth was found to involve both sides of the larynx, extending around the anterior commissure; its center was ulcerating and almost gangrenous, and its edges were raised into an indurated ridge.

The postoperative microscopic diagnosis was epithelioma, mostly of the basal cell type.

Convalescence was uneventful, and healing was slow. The wound closed within thirty-three days, with an unhealthy looking scar. Two weeks later, the scar broke down in the center, just under the chin. On December 27 the record stated: "Wound open and leaking and plastic operation seems inevitable." The wound was

Fig. 37.—Same larynx as that in figure 36 after removal, showing the tremendous increase in growth in spite of intensive roentgen treatment.

strapped, and the edges were freshened by shaving with a sharp knife. My associates and I were afraid to perform a plastic operation and temporized. The wound finally closed on Jan. 5, 1928, two and one-half months after operation.

Comment.—It seems to me that as the years go by cancer is attacking younger and younger subjects. I am no longer surprised to find cancer of the larynx in patients in their thirties. This patient is the youngest seen. In spite of the apparent benignity of the growth microscopically, it grew with amazing rapidity and seemed to be highly malignant clinically. Irradiation was useless; in fact, it not only nearly cost the patient her life in delaying the operation, but almost prevented closure of the wound. Antecedent chronic laryngeal pathologic change was also present.

TUBERCULOSIS AND SQUAMOUS CELL CARCINOMA OF THE LARYNX

CASE 12.—D. C., a man, aged 66, referred to me by Dr. Joseph Greene of Asheville, N. C., had had tuberculosis of the lungs for six years, with severe exacerbations. He had four pulmonary hemorrhages during this period. Roentgen examination showed extensive disease in both lungs, with the formation of cavities. The sputum was always loaded with tubercle bacilli. He had had chronic parenchymatous nephritis and occasional glycosuria, with a blood sugar content of from 180 to 190 mg. The blood pressure was 172 systolic and 100 diastolic. Several years before admission, two operations were performed on the gallbladder, the last at the Mayo Clinic, for cholelithic adhesions. The morphine and heroin habit was acquired during this period and had persisted ever since. When first seen, in June, 1927, the patient was taking about 4 grains (0.26 Gm.) of morphine a day to relieve the pain in the larynx, which was extreme.

At the Mayo Clinic, prior to the operation on the gallbladder, a 2 plus Wassermann reaction was obtained; this was not confirmed elsewhere, except that in Dr. Dunn's laboratory in Asheville spirochetes were said to have been found in the secretion from a laryngeal pustule. In my opinion, it is doubtful whether the patient ever had syphilis.

The patient was a liberal drinker of alcohol, though he was never known to show its effects, having an abnormally high alcoholic threshold.

Chronic hoarseness had been present for several years; the cause was unknown. In January, 1927, acute laryngitis developed, with pain and tenderness over the left lateral wall of the larynx and dysphagia. These symptoms persisted until the time of operation (laryngectomy) in October. The pain was severe enough to require from 2 to 4 grains (0.13 to 0.26 Gm.) of morphine a day.

Examination.—My first examination was made on June 3. The patient was moderately hoarse and complained of constant laryngeal pain on the left side and of dysphagia. The left wall of the larynx was displaced inward by a deep-seated growth or inflammatory swelling. The mucous membrane of the larynx was congested, smooth and unbroken, except over the arytenoid cartilages, where two grayish spots like blisters were seen, from which pus had been evacuated by puncture. The interarytenoid space and the right side of the larynx were normal, except for congestion. There were complete fixation at the left side of the larynx and tenderness and some swelling over the external aspect of the thyroid cartilage on the left side. At one point here, about as large as the end of the index finger, the tenderness was acute. At biopsy, on June 3, two good-sized pieces were taken from the area of greatest thickening just in front of the left arytenoid cartilage. Dr. Francis Carter Wood reported: "The laryngeal tissue shows only a chronic productive lesion of the connective tissue with large dilated blood vessels and highly cellular fibrous tissue. The diagnosis is doubtful. It might be well to give iodide of mercury. If there is no response, the lesion is probably tuberculous." In July the laboratory found Spirochaeta pallida in a small pustule in the patient's larynx.

Course.—I did not see the patient from June 3 until September 27.

On August 4, Dr. Greene reported: "The patient has been given six doses of neoarsphenamine. The growth seems to be reduced in size about one third. Unfortunately, he still requires morphine and codeine for pain. The swelling on the left side of the thyroid externally has almost disappeared, although there is still some tenderness which makes me fear chondritis or perichondritis."

On September 10 Dr. Greene again reported: "The arytenoid swelling has been greatly reduced although the swelling of the left vocal cord band is still very

prominent. The pain is persistent. The tender spot on the neck is the same, but there is no swelling. I have punctured several pustules which were visible through the mucous membrane."

On September 27 I found the following condition: The laryngeal picture was quite different from that seen in June (my last examination). In the center of the laryngeal lesion was a depression surrounded by a proliferating edge. A drop of pus was observed to exude from this crater-like opening, especially if pressure was applied over the tender area on the left outer wall of the thyroid cartilage. The growth or inflammatory mass was about the same size as it was in June. The inflammatory edema extended farther upward into the region of the aryepi-

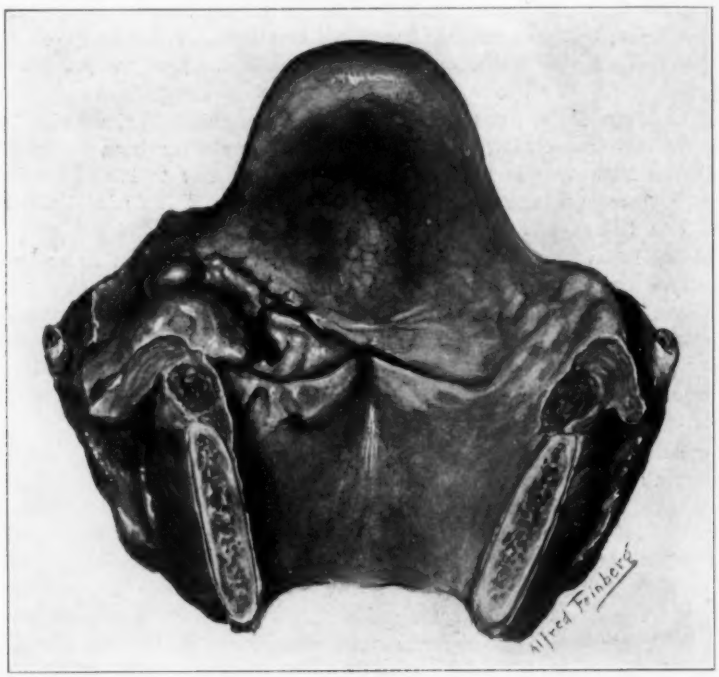

Fig. 38.—Postero-anterior view of the larynx of D. C., a man, aged 66, showing changes due to cancer, tuberculosis and syphilis (?). The cancer has grown around the tuberculous fistula.

glottic fold. From the appearance, malignant disease now seemed to be a certainty. The patient was expectorating daily about ½ pint (236.5 cc.) of tuberculous pus, but looked fairly well and weighed 210 pounds (95.2 Kg.). The pain in the larynx was acute and distressing. A second biopsy was performed by Dr. Jackson.

Dr. Wood's report on the examination of the tissue was as follows: "The sections show unquestionably squamous cell epithelioma with undoubted tuberculosis in the deeper layers. The epithelioma is rapidly growing, showing a large number of mitoses in the cells and is penetrating the deeper layers. The tuberculosis lies in the subepithelial layers. There are numerous typical tubercles with well formed Langhans' giant cells, which is a totally different picture from the sections which I first saw and illustrates the difficulty of diagnosis."

Dr. James Ewing of the department of pathology of Cornell University gave a more hopeful report. After stating that the growth was a "true epidermoid carcinoma of adult, squamous type," he went on to say that "the degree of cell anaplasia is slight, and if one were to grade the case in order of malignancy one would class it as grade 1 among the true carcinomas. Therefore, we have to deal with a squamous carcinoma of the larynx, papillary in type, of moderate malignancy and apparently of limited extent."

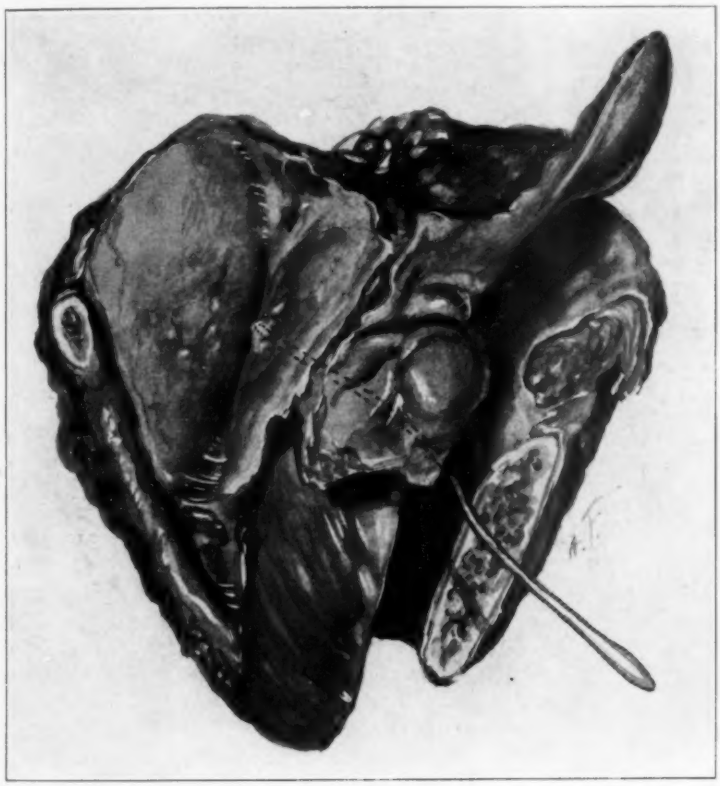

Fig. 39.—Lateral view of same larynx as that in figure 38. Tuberculosis has involved the perichondrium and cartilage. The probe is in the fistula. The cancer is in the lumen of the larynx around the fistula. Erosion of the thyroid cartilage should be noted (tuberculosis).

Operation.—On October 10, total laryngectomy was performed, with the patient under morphine-scopolamine hydrobromide and procaine hydrochloride-ethylene anesthesia. The epiglottis, part of the mouth of the esophagus and a liberal section of tissue lateral to the aryepiglottic fold on the left side were removed with the larynx.

Comment.—Tuberculosis, cancer and perhaps syphilis were present in this larynx. An antecedent pathologic condition was present in the

larynx for years, as was shown by the hoarseness. Pain and dysphagia were present from the onset, pointing strongly to the probability that tuberculosis antedated the cancer by several months. The tuberculosis probably started in the deep structure of the larynx near the perichondrium. The first biopsy gave negative results. The second gave positive results, but by that time the clinical evidence was unmistakable.

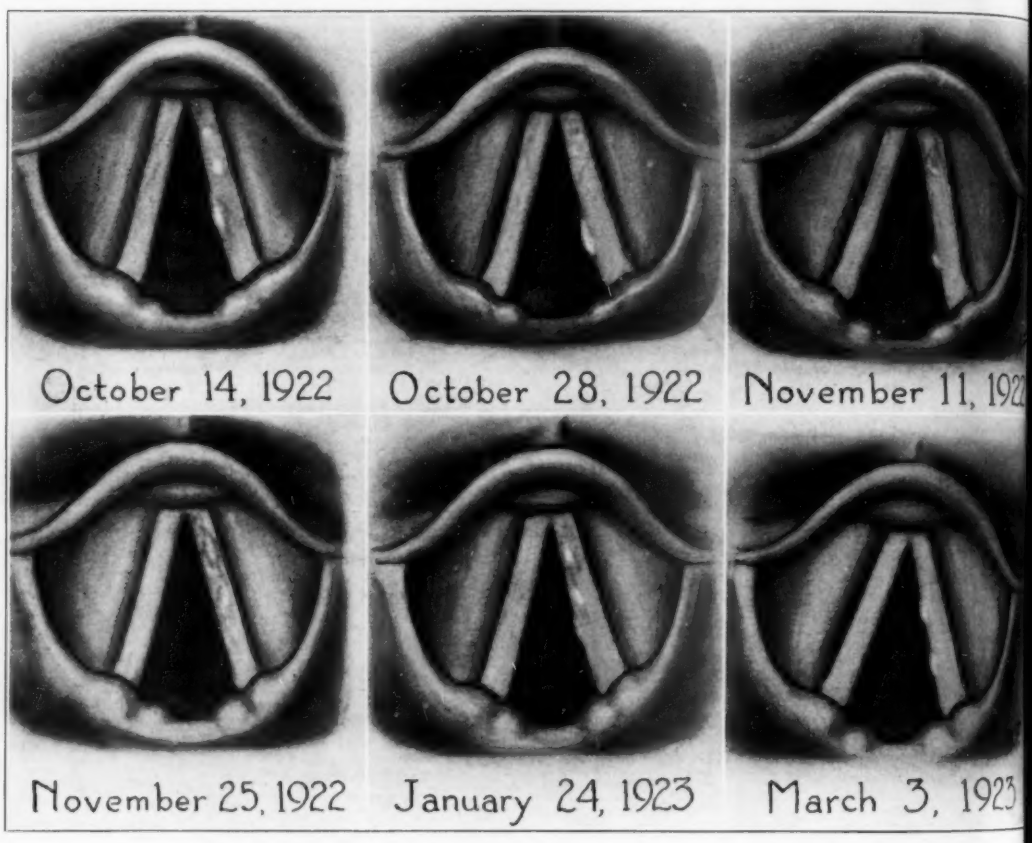

Fig. 40.—Drawings showing the peculiar changes in the larynx of E. G., a man, aged 67, during the period indicated. The entire left vocal cord seemed to be involved at various times, with a predilection for the junction of the middle and posterior thirds. White, raised, recurring keratotic areas were present.

INTRINSIC SQUAMOUS CELL CARCINOMA OF THE LARYNX

CASE 13.—E. G., a man, aged 67, was under observation for peculiar pathologic changes in the larynx from Oct. 14, 1922, until Dec. 27, 1927, when he was operated on for cancer.

The points in the past history bearing on the subsequent development of cancer were: For eight years prior to 1922, he had frequent attacks of coryza, with

hoarseness and at times aphonia. Six months before the first examination, in 1922, the hoarseness became worse. The opinion of the consultants was that this condition was caused by a greatly inflamed larynx. Dr. Jackson saw the patient in June, 1922, and said that the possibility of malignant disease could not be eliminated without biopsy. He advised a section. Permission was refused. Tuberculosis and syphilis were excluded.

When I saw the patient in October, 1922, the voice was almost normal. The pathologic condition had affected only the left vocal cord. There were small round spots

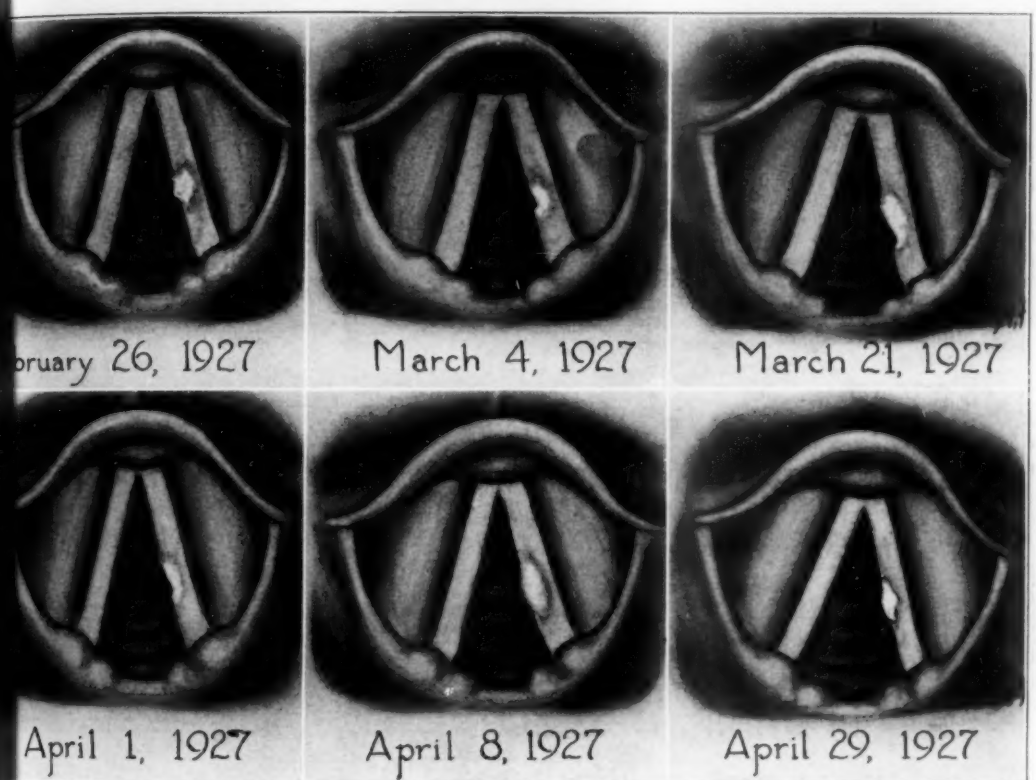

Fig. 41.—Drawings of the same larynx as that in figure 40, showing the changes during the period indicated. At this time the disease seemed to center entirely around the middle third of the cord.

on the upper surface of the cord (superficial ulcers), thickening on the edge at the middle and posterior thirds and congestion. There was severe pyorrhea alveolaris. Figure 40 shows the changes that took place in the larynx up to November, 1924 (two years later), at which date the larynx was normal. It remained so for two years, up to November, 1926. During this time the patient was taking small doses of sodium iodide intermittently, about 5 grains (0.3 Gm.) a day.

In November, 1926, the hoarseness returned, and a white raised spot appeared on the upper surface of the left vocal cord, about its center. I made the note that

it looked like hyperkeratosis. From this time to the end the pathologic changes in the cord were single, not multiple, as in the earlier stages.

In March, 1927, the appearance was highly suggestive of incipient cancer, and the patient was sent to Dr. Jackson for examination. He agreed on the probability of malignant disease. Biopsy was advised, but the patient deferred it.

In April and May the ulcer shrank to one fourth its former size; it filled in but did not close. Bright red points appeared in its center. The voice was better.

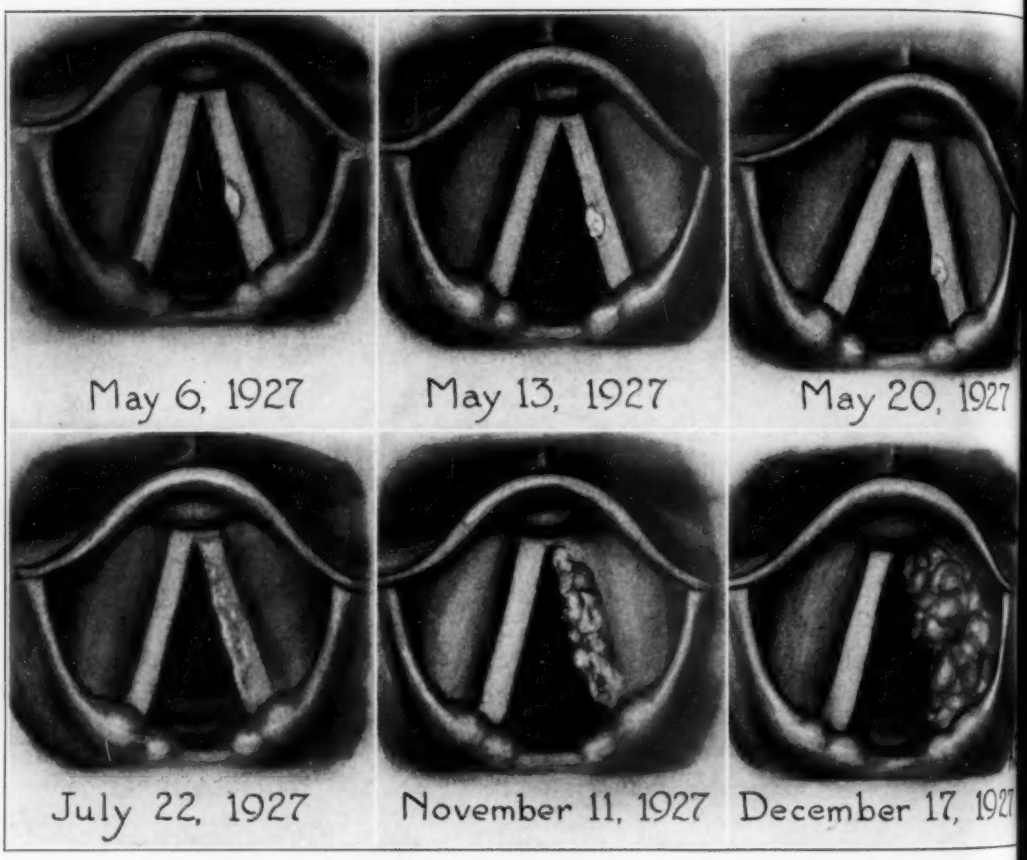

Fig. 42.—Drawings of the same larynx as that in figures 40 and 41, showing the appearance of the cord during the time indicated. A biopsy performed about June 25 gave negative results. On July 22 the cord seemed to be normal. Dr. Jackson saw the cord on August 20, when it was normal. The tremendous rapidity of the growth of cancer between November and December should be noted.

In June the condition was worse, and biopsy was insisted on. The patient was again sent to Dr. Jackson. Mobility was normal.

On June 25, Dr. Jackson reported: "I feel confident from the sensation transmitted to the forceps, as well as from the direct laryngoscopic appearance, that

the growth is benign. Therefore, I deemed it best to remove the entire growth. My diagnosis is chronic inflammatory lesion."

One of my associates had the patient under observation from July 1 to August 6. He reported, on August 6: "The left cord is much improved. There is still a slight thickening. The mucous membrane looks quite normal."

Dr. Jackson saw the patient on August 20, and reported: "Taking the histological findings together with the appearance of mirror laryngoscopy, the conditions in the larynx do not seem to me to call for any surgical procedure." The patient was not seen from August 20 to November 11.

About two and a half months later, on November 11, the larynx presented the typical appearances of a fulminating cancer. The entire left vocal cord was involved in a proliferating mass, and mobility was impaired. The patient was sent to Dr. Jackson for a second biopsy. The diagnosis was squamous cell cancer.

Fig. 43.—Same larynx as that in figures 40, 41 and 42, after removal, showing extensive carcinoma growing downward and backward.

Because of a severe attack of grip, the patient was not in a condition to withstand operation until December 21. After all these years of watching and circumventing every possible avenue of error, we now had an advanced intrinsic cancer to deal with, in spite of all our efforts. If I had not had the unerring skill and judgment of Dr. Jackson covering every move, I might have blamed myself for overlooking the malignant condition in June. I am confident, however, that the actual malignant disease, so far as clinical and laboratory experience could orient us, did not set in until after Dr. Jackson's observation in August. Yet, potentially, the condition was malignant long before.

Here is another example of the premalignant stage of cancer. I believe that this stage is invariably present, but opportunity for observing it comes rarely.

Operation and Course.—On December 21, laryngectomy was performed. The growth extended close to the aryepiglottic fold. The left side of the larynx

was entirely involved. The tissues in the vicinity of the aryepiglottic fold on the lateral wall were extensively removed with the epiglottis. Recovery was complicated by osteoperiostitis (embolic) of the first right metatarsal bone. The temperature was 106 F. for several days. Eventually, the toe and part of the metatarsal bone had to be removed. In spite of this the wound closed, and the patient was able to swallow fourteen days after the operation. The patient died of cancer of the neck one year after operation.

Comment.—Under observation, an apparently benign growth became malignant. Or was the larynx cancerous from the start and the condition overlooked because of our abysmal ignorance of this disease? When more is known about cancer, will it be possible to differentiate between the truly benign growth which never becomes malignant and the apparently benign growth which always becomes malignant?

I believed for years that this larynx would some day present the typical picture of cancer. It is undeniable that certain appearances in the larynx suggest malignant disease to the experienced clinician long before the disease can be demonstrated clinically or biologically.

The rapidity of the growth was phenomenal, eventually defeating the painstaking efforts to stop it. Just a few weeks before the larynx was half filled with cancer, my associate and Dr. Jackson pronounced the condition practically normal. The first biopsy by Dr. Jackson gave frankly negative results.

PLASMOCYTOMA AND RHABDOMYOMA OF THE PARANASAL SINUSES

PATHOLOGIC AND SURGICAL CONSIDERATIONS; REPORT OF CASES

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Attention has been drawn in recent years to a considerable number of reported cases of a comparatively rare form of myeloma which occurs in various parts of the upper respiratory tract, resembling histologically the multiple myelomas commonly found in the long bones but differing clinically in many respects. The growths are designated as solitary plasmocytomas and pathologically may be classified as malignant lymphomas, of which the multiple myeloma and solitary plasmocytoma represent subgroups. Many cases of multiple myelomas are already on record (Walgren [1] reported one hundred and twenty-five occurring in the long bones, of which thirty-five were of a definite plasma cell structure), and many other cases have occurred since then while only comparatively few cases of solitary plasmocytoma have been reported. The great majority of these solitary plasmocytomas have occurred in the upper respiratory tract, principally in the nose and pharynx, and because of their solitary nature they have been particularly amenable to treatment. In a few of the reported cases plasmocytomas occurring in this locality were associated with metastases and followed the usual course of malignant tumors. Two additional cases are reported in this paper, neither of them associated with metastases and one requiring a radical external approach for complete removal of the growth.

PLASMOCYTOMA

CASE 1.—*Plasmocytoma of the nasal bone.*

Mrs. E. G. S., aged 45, first noticed a swelling, the size of a small nut, on the left side of the nose in 1927. The onset was gradual and associated with a slight amount of pain and troublesome nosebleed. As the tumor began to grow larger, the bone underneath seemed spongy and tender. She consulted her local physician, who referred her to Dr. S. M. Withers. He found an oval tumor mass which measured 2 by 2 cm. and which was elevated 1 cm. on the left side of the nose; the overlying skin was discolored. The mass was semifluctuant and adherent to the underlying tissues.

Inspection of the nose showed a ragged margin of ulceration in the upper portion of the naris which was tightly adherent to the left lateral wall at the junction

From the Department of Otolaryngology, University of Colorado.

1. Walgren, A.: Virchows Arch. f. path. Anat. **232**:381, 1921.

of the nasal and maxillary bones. No palpable glands were found. Roentgenograms of the sinuses and chest failed to show a pathologic condition associated with the tumor.

Biopsy on March 16, 1929, showed a malignant lymphoma.

Treatment consisted of radium therapy (180 mg. hours), which caused the external swelling to disappear. In October 1931 the patient's physician reported that there were still an ulceration and a small growth in the vicinity of the left midmeatus. The patient did not return for further treatment, as advised.

CASE 2.—*Plasmocytoma of the left antrum.*

Mr. W. D. R., aged 68, a farmer, entered the Colorado General Hospital on Oct. 17, 1933, complaining of a burning sensation and swelling of the left side of the face, with continuous frontal and temporal headaches.

History.—He had been well until a year previously, when on rising in the morning he complained of severe generalized headaches. He had not suffered

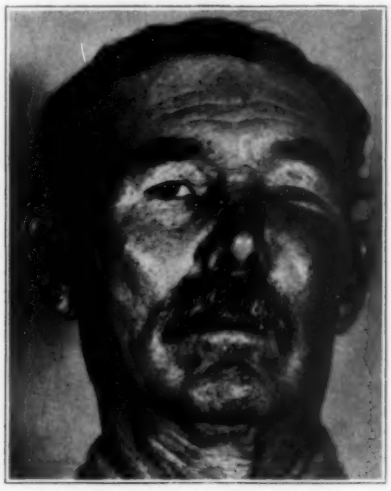

Fig. 1.—The appearance of the tumor mass which involved the left side of the face before operation.

from any previous disease of the sinuses. He had lived outdoors most of his life and had had no prolonged illness. He abstained from tobacco, but admitted that he used alcohol moderately. Six months later his headaches became more constant, localizing between the eyes and over the frontal sinuses. Disease of the sinuses was suspected because of difficulty in breathing on the left side and a dark maxillary antrum. An inferior meatal window operation was performed without benefit. Three weeks later the left cheek began to enlarge, spontaneous epistaxis, sometimes prolonged, appeared from the left side of the nose, and the headaches increased in severity. He had lost 14 pounds (6.4 Kg.) during the past month.

Physical Examination.—On admission the patient presented an enlarged, firm, nonfluctuant mass over the left cheek which deflected the cartilaginous portion of the nose to the opposite side (fig. 1).

The palpebral fissure was also narrowed. The left eye showed mild conjunctivitis with lacrimation and tears running down the cheek from obstruction

of the lacrimal duct. The pupils reacted to light and in accommodation. The left anterior naris was completely obstructed from impingement of the turbinates against the septum. There was considerable congestion, and what could be seen of the middle turbinate appeared cauliflower-like and hemorrhagic. A slight degree of atrophy of the mucous membrane was present in the right side of the nose. The left posterior naris showed a portion of the tumor mass protruding into the nasopharynx. Many of the teeth had been extracted. Those remaining in the lower jaw were decayed and required extraction. The tonsils were small and buried; secretion could be expressed from them. The breath was foul. The larynx was normal. The neck showed no glandular adenopathy.

A provisional diagnosis of carcinoma of the left maxillary sinus was made.

Roentgen Examination.—A dense homogeneous opacity of the left ethmoid, sphenoid and maxillary sinuses was revealed. The frontal sinuses were large and comparatively clear. The femurs, the left humerus and the skull failed to show metastases.

Biopsy.—Plasmocytoma of the antrum was evident. Tissue from the antrum consisted of polypoid masses covered by high columnar epithelium which was pseudostratified. Some of the cells showed marked hyperplasia. The mucous glands were numerous. The stroma on the whole was moderately dense and contained many blood vessels. It was infiltrated with a small number of lymphocytes and many plasma cells. There were occasional areas of polymorphonuclear leukocytes. Areas of bone and cartilage were scattered throughout. There were large, indefinitely outlined areas of large round cells with basophilic cytoplasm and round eccentric nuclei of variable staining quality. They formed portions of polypoid masses and appeared to invade the adipose and bony tissues. Mitotic figures were present. This was a malignant round cell tumor, suggesting a plasma cell myeloma (fig. 2).

Laboratory Examination.—The hemoglobin was 15 Gm. (16 Gm. is equivalent to 100 per cent); the red blood cells numbered 5,200,000; the white blood cells, 8,400. Polymorphonuclears numbered 84; lymphocytes, 15, and eosinophils, 1. There were no plasma cells. The Wassermann test was negative. One test of the urine gave results suggestive of Bence-Jones protein; another was negative for this substance. The blood pressure was 160 systolic and 105 diastolic.

Operation.—On Nov. 8, 1933, a lateral rhinotomy was performed through the left cheek after the manner described by Dr. Harry A. Barnes [2] of Boston in the treatment of malignant conditions of the antrum. Considerable bleeding was encountered when the tumor was incised, making progress slow and difficult. Hot packs applied with pressure soon checked the hemorrhage and facilitated the removal of the bone overlying the maxillary sinus, which was necrotic. To the naked eye the tumor was soft, reddish gray and friable; it was easily removed with a large curet. The floor and the lateral wall of the antrum were firm and not invaded by the tumor. The nasal antral wall, already displaced toward the septum, was a spongy mass of necrotic tissue offering no resistance to its removal with grasping forceps and a curet. The posterior wall of the sinus was likewise of soft bone which yielded to the gentle pressure of the probe. It was decided that the tumor mass had for a short distance invaded the pterygomaxillary fossa by eroding the posterior wall of the sinus in the same manner that it had eroded the anterior wall and infiltrated the cheek. As much of the posterior bony wall

2. Barnes, H. A.: Malignant Tumors of the Nasal Sinuses, Arch. Otolaryng. **6**:123 (Aug.) 1927.

was removed as seemed advisable, the remainder of the tumor cells being left to be destroyed by radium. A complete removal of all of the ethmoid cells, including a portion of the floor of the orbit and all of the lamina papyracea and medial wall of the orbit, followed. The sphenoid was opened, and the mucous membrane removed without gross evidence of malignancy, biopsy showing only chronic inflammatory tissue.

At the completion of the operation the upper portion of the wound was sutured together, and a small opening in the cheek was left for inspection and for the insertion and removal of radium. Radium (4,800 mg. hours) screened with 2 mm. of lead and 1 mm. of brass was placed up against the anterior boundary of the

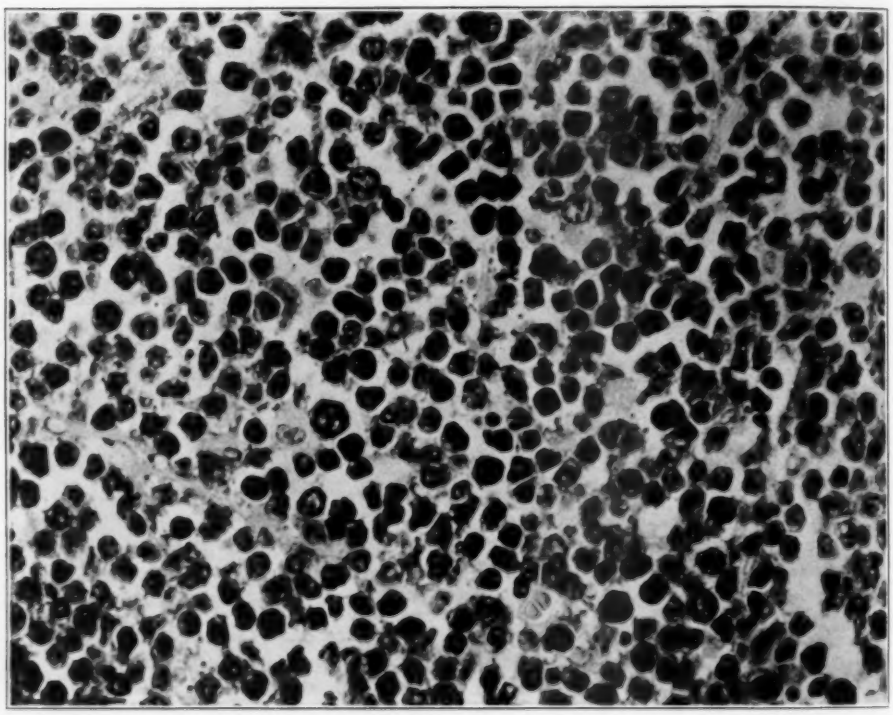

Fig. 2.—Photomicrograph of a plasmocytoma removed from the left antrum, ethmoid and sphenoid.

pterygomaxillary fossa. One week later, radium (1,900 mg. hours) screened in the same manner was placed endwise in the wound just inside the margin of the skin to destroy the infiltration of cells into the cheek. The total dosage was 6,700 mg. hours. The window in the incision was left open for a few months to insure that no recurrence would escape observation. A plastic closure will be performed at a later date.

Comment.—Plasma cell tumors are chiefly found in (1) the upper respiratory tract and (2) the skeleton, particularly the medullary portion of the long bones. Plasma cell tumors of the air passages are more commonly solitary and tend to invade adjacent structures by con-

tinuity. Lymph glands are rarely involved, and metastasis is uncommon. Because of their solitary nature these growths are more amenable to treatment by surgery, radium or a combination of both. Several authors have published reports of cases of solitary plasmocytoma (Shaw,[3] Walthard,[4] Pentman,[5] Martin,[6] Nicod,[7] Rogers,[8] Nemours, Perrott and Crocquefer,[9] Jackson, Parker and Bethea,[10] Claiborn and Ferris,[11] Stewart and Taylor,[12] Blacklock and Macartney [13] from which a detailed description of the pathologic and clinical aspects may be obtained. They are comprehensively described and illustrated so that further comment is unnecessary except to summarize briefly the thirty-two cases reported as occurring in the following localities: Shaft of the humerus (five cases); anatomic neck of the femur (one case); shaft of the femur (one case); crest of the ilium (one case); seventh cervical vertebra (one case); vault of the skull (one case); superior maxilla (two cases, including case 2 of this report); anterior nares (two cases, including case 1 of this report); uvula (one case); interior of the larynx (one case); nasopharynx (two cases); inferior turbinate and nasal cavity (three cases); septum (one case); ethmoid cells (one case); pharyngeal orifice of the eustachian tube (one case); tonsils and pharynx (one case); lymph node (one case); margin of the gum (one case); five additional cases showed multiple involvement of the upper air passages or associated metastases to the bones or abdominal viscera and are therefore considered separately from the solitary growths. Pinney's [14] case of plasma cell leukemia, with plasma cells composing from 14 to 42 per cent of the total white blood cell count, and Jackson, Parker and Bethea's [10] case of pseudoleukemia, with 6.5 per cent plasma cells in the blood stream, are unusual and interesting.

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3. Shaw, A. B. F.: J. Path. & Bact. **26**:125, 1923.

4. Walthard, B.: Schweiz. med. Wchnschr. **54**:285 (March 20) 1924.

5. Pentman, I.: Beitrag zu den multiplen Myelomen, Virchows Arch. f. path. Anat. **258**:161, 1925.

6. Martin, J. F.; Dechaume, J., and Levrat, M.: Bull. Assoc. franç. p. l'étude du cancer **17**:537, 1928.

7. Nicod, quoted by Martin.[6]

8. Rogers, H.: Brit. J. Surg. **17**:518, 1929.

9. Nemours, Perrott and Crocquefer: Plasmosarcome du maxillaire supérieur, Rev. de stomatol. **33**:457, 1931.

10. Jackson, H., Jr.; Parker, F., Jr., and Bethea, J. M.: Am. J. M. Sc. **181**: 169, 1931.

11. Claiborn, L. N., and Ferris, H. W.: Plasma Cell Tumors of the Nasal and Nasopharyngeal Sinuses, Arch. Surg. **23**:477 (Sept.) 1931.

12. Stewart, M. J., and Taylor, A. L.: J. Path. & Bact. **35**:541 (July) 1932.

13. Blacklock, J. W., and Macartney, C.: J. Path. & Bact. **35**:69, 1932.

14. Pinney, A.: Folia haemat. **30**:173, 1924.

On the other hand, plasma cell tumors of the bony skeleton usually make their appearance in the shafts of the femur, humerus, ilium and vertebral bodies, are multiple, metastasize via the blood stream and at postmortem examination are found in the lymph glands, ribs, liver, spleen and other organs of the body.

Fifty per cent of the cases of multiple tumors and only a few of the cases of solitary tumors show Bence-Jones protein in the urine.[11] It was not definitely present in case 2. Plasma cell tumors of the skeleton commonly are termed multiple myelomas and histologically are identical with those found in the upper air passages, so that a clearcut distinction between the two pathologic conditions is not practical. Clinically, however, there is a difference, especially in their prognosis.

Stewart and Taylor [12] stated the belief that the origin of the tumor lies in a single focus in the medullary cavity or cancellous bone which slowly erodes the outer layer of compact bone and infiltrates the surrounding tissues. The tumors arising in the shaft of the long bones metastasize via the blood stream and have usually invaded the medullary cavity of other bones by the time the diagnosis is confirmed. In this case the tumor originated in the sinus, spreading by continuity, distorting the nasal antral wall and turbinates, eroding the bone overlying the left antrum and infiltrating the cheek. Many authors, such as Hoffmann,[15] Geschickter [16] and Schriddle,[17] have reported extra-osseous tumors.

Two of the seventeen tumors in Jackson's series were extra-osseous. Various authors have stated the opinion that these plasmocytomas are of inflammatory origin because of their slow growth and solitary occurrence without metastases and because of the presence of large numbers of plasma cells in specimens from syphilitic and tuberculous patients. Locally, plasma cell tumors have occurred on the lips, conjunctiva and anus without glandular involvement. Few, and sometimes no, mitotic figures are present, and the diagnosis is made by exclusion. Weitzleben [18] stated that plasmocytomas are due to a disease of the hematopoietic system, Pappenheim [19] confirmed his statement.

Other writers strongly believe that the tumors are malignant, and substantiate their views by observations at autopsy. One case of Jackson's [10] in which a tumor appeared in the tonsil and lymph gland in the neck, followed by metastases to the ribs, long bones and vertebrae, and another in which a tumor appeared in a deep cervical gland and

15. Hoffmann, R.: Arch. f. Dermat. u. Syph. **68**:217, 1904.

16. Geschickter, C. F., and Copeland, M. M.: Multiple Myeloma, Arch. Surg. **16**:807 (April) 1928.

17. Schriddle, H.: Weitere Untersuchungen über die Kornel-Urgen der Plasmazellen, Centralbl. f. allg. Path. u. path. Anat. **16**:433, 1905.

18. Weitzleben: Ztschr. f. Krebsforsch. **22**:422, 1925.

19. Pappenheim: Folia haemat. **4**:206, 1907.

metastasized to the inguinal and retroperitoneal glands and the medullary cavity of the iliac crests, femurs, skull and other areas substantiate the belief in a malignant character. Microscopically, the type of cell (to the exclusion of all others), the presence of mitotic figures, the absence of organisms and the extreme vascularity of the tissue are in favor of malignancy.

Prognosis.—Multiple myelomas are usually fatal. However, the prognosis is more hopeful for the solitary plasmocytomas. Of the types of therapy used, a combination of surgery and radium seems to have given the best results. Radium seems to have been used more recently because of the two or more surgical removals that were necessary in some of the cases reported.[11]

In one case in particular (Jackson, Parker and Bethea[10]) following surgical intervention and treatment with radium there was a recurrence after eight years. In another case a tumor on the anterior margin of the gum was completely cured by operation and postoperative irradiation. High voltage roentgen therapy seems to have had little effect on the cases reported and is not to be recommended. Nemours, Perrott and Crocquefers reported that there was no recurrence in the superior maxilla eighteen months after surgical intervention and treatment with radium.

RHABDOMYOMA

CASE 3.—*Rhabdomyoma of the Paranasal Sinuses.*

Mr. W. A., aged 67, a laborer, entered the Colorado General Hospital on Dec. 27, 1933, complaining of pain in the left side of the face, continuous occipital headache, diplopia and impaired hearing in the left ear.

History.—The family history was not important. The patient's wife had three miscarriages in early life, the causes of which were unknown.

About two months prior to admission, the patient noticed a swelling of the inner canthus of the left eye which developed gradually and which was associated with a headache in the left supra-orbital and occipital regions. He had been troubled with nosebleeds off and on and was unable to breathe through the left nostril. The swelling, which increased gradually, was associated with more headache and proptosis of the left eye. Diplopia had been present for the past two weeks, and a small cervical gland, which had been enlarging simultaneously with the swelling in the cheek, was noticed in the left submaxillary region.

Physical Examination.—The important findings were proptosis of the left eye and paralysis of the cervical sympathetic fibers to the iris, or Horner's syndrome (fig. 3). Chronic conjunctivitis with epiphora and displacement of the left eye upward and outward were present. There was moderate tenderness over the antrum and the ascending process of the superior maxilla. Vision was normal. There was complete obstruction of the left nostril by a red, fungating tumor mass. The tumor had protruded into the vestibule and covered all except a small portion of the inferior turbinate. It bled easily and could not be displaced. There was a compensatory displacement of the cartilaginous portion of the nose toward the right side. Palpation of the left canine fossa showed a tender, nonfluctuant mass; the right fossa was normal. A small tab of tumor tissue could be seen lying in

the posterior naris and in the region of the eustachian tube. The mouth was edentulous. The neck showed enlargement of a small palpable cervical gland in the vicinity of the submaxillary gland. No other glands were palpable. The thyroid was normal. The heart, lungs and abdomen were normal. The blood pressure was 170 systolic and 80 diastolic. The prostate was not enlarged.

Laboratory Examination.—Urinalysis, blood counts and the Wassermann test repeatedly gave negative results. Roentgenograms of the left antrum and of the ethmoid and sphenoid sinuses were homogeneously dense. The rest of the sinuses were clear. The chest did not show metastases.

Biopsy.—A specimen taken from the tumor mass in the nose showed chronic inflammatory tissue. One from the inferior turbinate and cervical gland showed an undifferentiated carcinoma. The pathologic report stated that the specimen

Fig. 3.—*A*, the appearance of the patient before operation. Notice the paralysis of the sympathetic fibers to the eye (Horner's syndrome). *B*, the appearance of the patient two weeks after the operation.

consisted of tissue from (1) the posterior ethmoid, (2) the posterior wall of the sphenoid, (3) the floor of the sphenoid and (4) the right antrum. The gross description was as follows: All of the specimens were received in formaldehyde and consisted of irregular fragments of firm, reddish-white tissue covered with tags of blood clot. The cut surfaces showed a uniform, firm, yellowish-white tissue. The specimen from the posterior wall of the sphenoid contained small bony fragments. The largest specimen from the posterior wall of the sphenoid measured 1.5 by 1 by 0.5 cm.; the largest from the floor of the ethmoid, 3 by 1.2 by 1.3 cm., and two masses from the antrum, 2.5 by 2 by 1.1 cm. and 2 by 1.5 by 0.9 cm., respectively.

Microscopic Examination.—The tumor consisted of a moderate amount of a loosely woven, almost myxomatous type of connective tissue which supported a

diffuse mass of large, deeply staining cells which took the acid stain with hematoxylin and eosin. There was no apparent characteristic arrangement of the tumor cells. The stroma itself was infiltrated with lymphocytes and plasma cells and, in some of the outer portions of the specimens, with polymorphonuclear neutrophils. Vascularization was poor, and the vessels present were chiefly dilated capillaries. In some sections there were a few scattered mucous glands, typical of those usually found in the nasal mucosa.

The tumor cells varied markedly in size and shape and had irregular outlines. On the whole they were large cells, round, oval, blunt spindle-shaped and ribbon-shaped. The cytoplasm was clear, staining deeply in the majority of the cells (although in some it was pale); in some it was finely granular, and in a few cells definite cross-striations were noted. In others the striations were fragmentary and not well differentiated. In some cells the cytoplasm was vacuolated or contained a fibrillar network. The nuclei were likewise variable in size and shape. The majority were eccentric, hyperchromatic, round, crescent or lobulated. Some of the cells were degenerating and showed fragmentation of the nuclei. In a small number of cells there were multiple nuclei. Mitotic figures were not frequent.

The specimen from the posterior ethmoid region had a partially polypoid arrangement, and the tumor tissue extended almost to the covering epithelium, being separated only by a narrow layer of fibrous tissue. The specimen from the posterior wall of the sphenoid consisted of solid masses of tumor tissue, and in addition there were included trabeculae of newly formed bone. The portion taken from the floor of the sphenoid, like that from the ethmoid, consisted of solid tumor tissue which extended up to the mucous membranes. The antral tissue was similar except that in areas the connective tissue stroma was dense, there was marked polymorphonuclear infiltration of the peripheral portions of the tissue, and here, too, there were small areas containing bone.

Pathologic Diagnosis.—The condition was diagnosed malignant rhabdomyoma of the paranasal sinuses. Dr. A. C. Broders of the Mayo Clinic confirmed this diagnosis, stating the belief that the condition resembled rhabdomyosarcoma. Dr. James Ewing did not confirm the diagnosis, but believed that the condition was an atypical form of cancer.

Operation.—Four high voltage roentgen treatments were given prior to the operation, which occurred on Jan. 8, 1934. A lateral rhinotomy was performed according to the procedure of Dr. Harry A. Barnes of Boston, and the tumor mass was found to have eroded the anterior maxillary wall. The antrum was filled with a dense, cauliflower-like growth which after removal was found to have originated probably from the skeletal musculature of the pterygoid group. The posterior wall of the antrum and the tumor mass adherent to the internal pterygoid muscles were completely destroyed. The medial orbital wall was eroded from invasion of the tumor, and the nasal antral wall and the turbinates were likewise involved.

The floor of the antrum was intact except for a small area of softening which extended to the oral mucous membrane but did not perforate into the mouth. All of the tumor mass that was accessible was removed piece by piece, there being too much bleeding to use the coagulating current. The sphenoid and ethmoid sinuses were completely exenterated of tumor and mucous membrane. Bleeding was controlled with hot packs, and the incision in the face was left open for inspection and the insertion of radium (fig. 3*B*). Radium (1,200 mg. hours) screened in the same manner as in case 1, was inserted toward the floor of the antrum,

and a dosage of 600 mg. hours with additional screening of lead to protect the septum, was used in the ethmoid region. More radium and high voltage roentgen therapy were to be used at a later date.

Postoperative convalescence was uneventful. The most distressing symptoms were a foul odor and crusting of the wound, which required daily irrigation and removal with forceps.

Comment.—Rhabdomyomas are rare enough when found in the genito-urinary tract, uterus, heart and other organs, but they become curiosities when they appear in the paranasal sinuses in which voluntary or involuntary musculature is not present. The origin of the tumor was probably in the internal pterygoid (skeletal) muscle, with secondary invasion of the sinuses. There was no impairment of motion of any of the rectus muscles, so that origin within the orbit was rather unlikely. Metastases from the prostate or testis were not found on physical examination. Martin and Alexander [20] reported a case of rhabdomyoma of the soft palate in a child of 6 years discovered after a tonsillectomy and adenoidectomy. The rhabdomyoma recurred several times. Glandular involvement followed, which resulted in death in less than a year. In Reitter's [21] case of rhabdomyoma of the nose, which was even more advanced in external appearance than the one reported in this paper, radium alone was used. The progress of the case was not reported. Imperatori [22] briefly reported a case of rhabdomyoma of the larynx which was removed surgically and without recurrence. Ewing [23] said, "Few muscular regions in the body escape an occasional development of a rhabdomyoma. The largest number originate in the genito-urinary tract. Next in order is the neck and adjoining region." Cases of rhabdomyoma occurring in the nose, tongue, orbit, esophagus, parotid gland and testis are on record. They are akin to teratomas, as cartilage, bone and other tissues may be found in the microscopic sections. Other tumors that may be mistaken for rhabdomyomas are spindle cell sarcoma, myxosarcoma or tumors with anaplastic changes. Metastasis takes place via the lymphatic glands, and the cross-striations common to the tumor are found in glandular metastases.

Wolbach [24] (1928) reviewed the literature in general and gave a most comprehensive and detailed pathologic description, so that further comment here is unnecessary.

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20. Martin, G. E., and Alexander, W. A.: Rhabdomyosarcoma of the Soft Palate, J. Laryng. & Otol. **26**:312 (June) 1924.

21. Reitter, G. S.: Rhabdomyoma of the Nose, J. A. M. A. **76**:23 (Jan. 1) 1921.

22. Imperatori, C.: Tr. Am. Laryng. Soc., 1933.

23. Ewing, J.: Neoplastic Diseases, ed. 3, Philadelphia, W. B. Saunders Company, 1928.

24. Wolbach, S. B.: A Malignant Rhabdomyoma of Skeletal Muscle, Arch. Path. **5**:775 (May) 1928.

MacCallum [25] stated the belief that these tumors are usually benign at their onset and may become malignant. The origin is probably a rudiment from an early embryonal stage which, displaced in the course of development, has grown in an unusual situation.

SUMMARY

1. Solitary plasmocytomas and multiple myelomas belong to the general classification of malignant lymphomas, and while histologically identical, clinically they present different aspects.

2. A detailed report of two cases of solitary plasmocytoma is given with operative procedures.

3. Thirty-two cases of plasmocytoma have so far been reported in the literature, the majority of which were found in the upper respiratory tract.

4. A case of rhabdomyoma involving the paranasal sinuses and requiring the same surgical procedure as the cases of plasmocytoma is reported. A similar case has not been reported in the literature.

5. A combination of operation and postoperative irradiation seems to give the best therapeutic results.

652 Metropolitan Building.

25. MacCallum, W. G.: Textbook of Pathology, ed. 2, Philadelphia, W. B. Saunders Company, 1920.

MYCOTIC INFECTIONS OF THE MAXILLARY SINUSES

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In a previous communication [1] the discovery of a fungus, Mucor-Histoides, in pus recovered by irrigation from the maxillary sinuses of a patient was reported. The clinical picture in this infection was one of long-standing chronic sinusitis associated with chronic inflammatory changes in the membranes of the nasal chamber. One breast had been removed by a radical operation and showed on microscopic examination chronic mastitis. This fungus was found repeatedly over a period of months. It resembled cells of the human body so closely in its morphologic characteristics that its differentiation was difficult.

It might be well to outline briefly the forms of this fungus as seen in the microscope. The spores were of two kinds; one was plain and the other had lobulated chromatin which closely resembled the nucleus of a polymorphonuclear leukocyte. Yeastlike buds were at times present on the spores, but they also divided by direct fission and by segmentation into smaller elements. The vegetative part of the organism was usually a club-shaped hypha. The hyphae gave rise not only to the spores but also to other hyphae by a process of yeastlike budding. Evidence of segmentation was also seen at times in the end of the hyphae.

The literature on infection of the maxillary sinuses by fungi was reviewed in the previous communication [1] and by Adams [2] in a recent complete report of a case of sinusitis due to the fungus Aspergillus fumigatus. So few instances of this type of infection in the sinuses have been reported that they can again be easily enumerated here. Besides the two cases already referred to one case each has been reported by Mackenzie,[3] Harmer,[4] Skillern [5] and Mollari,[6] while Tilley [7]

Read before the American Laryngological, Rhinological and Otological Society, April 1934.

1. Stevenson, H. N.: Mucormycosis of the Maxillary Sinus, Arch. Otolaryng. **18**:775 (Dec.) 1933.

2. Adams, N. F. Jr.: Infection Involving the Ethmoid, Maxillary and Sphenoid Sinuses and the Orbit Due to Aspergillus Fumigatus; Report of Case, Arch. Surg. **26**:999 (June) 1933.

3. Mackenzie: Bull. Johns Hopkins Hosp. **4**:9, 1893.

4. Harmer, D., and Jockes, T.: Specimens of Aspergillus Fumigatus from Nasal Sinuses, Proc. Roy. Soc. Med. **12**:187, 1918.

5. Skillern, R. H.: Aspergillosis of the Maxillary Sinus, Laryngoscope **31**: 946, 1921.

6. Mollari, M.: Case of Mycosis of the Antrum, Ztschr. f. Hals-, Nasen- u. Ohrenh. **25**:65, 1929.

7. Tilley, H.: Aspergillosis of Maxillary Antrum, Proc. Roy. Soc. Med. **8**: 14, 1914-1915.

reported five cases of this infection in the maxillary sinuses, making a total of eleven cases. The fungi in ten of the cases were all in the family of Aspergillus and usually of the class of fumigatus.

The observations reported here are the result of a search for fungus forms in pus recovered from the maxillary sinuses by irrigation. The search has been stimulated by the abundance of cases of low grade chronic catarrh of the upper respiratory tract. This, with the sluggish growth of Mucor-Histoides evident on artificial mediums and the difficulty of differentiating the organism microscopically, made it seem likely that careful search would reveal additional cases in which this type of organism was present in the pus recovered from the sinuses.

There were seven cases in the series in which fungus forms were found. These forms were found to have a morphologic resemblance to those of Mucor-Histoides. The technic of obtaining the pus from the sinus and of fixing and staining the smears was similar to that given in the previous report. Outlines of the histories of these cases follow, with the microscopic observations briefly summarized.

REPORT OF CASES

CASE 1.—A woman, aged 23, who had always been well, was first seen in April 1928, with an acute right frontal sinusitis. Transillumination at this time showed that the right frontal sinus was dark. The left antrum was slightly dark. The patient was next seen on Jan. 9, 1931, when she was suffering from an acute infection of the upper respiratory tract. Transillumination at this time showed that the frontal sinuses were clear, and that the antrums were dark, the left being the darker. On January 10, the maxillary sinuses were irrigated, and pus was obtained from both. On January 12, the antrums were irrigated, and pus was obtained from both. The patient then returned to college, where treatment was to be carried out. Two years later, on Feb. 22, 1933, she was again seen. Off and on during the winter she had been having a low grade nasal infection and for about a week had had an ache in the cheeks and teeth. Transillumination showed that the right frontal sinus was dark. The antrums were dark, the right being the darker. Pus was washed from the maxillary sinuses on February 25 and March 4, 11 and 18, when the patient discontinued treatment.

Microscopic Examination.—On February 25, the right and left maxillary sinuses showed definite fungus forms resembling Mucor-Histoides. There were fairly well formed hyphae with buds and associated with spores which were plain or with lobulated chromatin. On March 4, 11 and 18, similar fungus forms were found.

CASE 2.—A man, aged 26, single, first seen on March 8, 1933, for about eight weeks had acute arthritis in the ankles and the right knee associated with a temperature as high as 100.5 F.

At one time he had his foot in a cast and was forced to use crutches. His tonsils were removed when he was a child. He was otherwise well. Transillumination showed that the frontal sinuses were clear and equal. The antrums were dark, the right being the darker. There was a slight discharge of mucus in the nose and the postnasal region. The maxillary sinuses were irrigated on March 8, 10, 14, 18, 22 and 31; on April 7, 14, 19 and 28, and on May 5 and

Fig. 1 (case 2).—Hyphae having attached buds. There are plain spores and spores with lobulated chromatin both with buds. Some spores in the field are connected by rods. A rudimentary hypha connected to the spores by rod formation is also present. Smear; Giemsa stain; projection drawing; × 540.

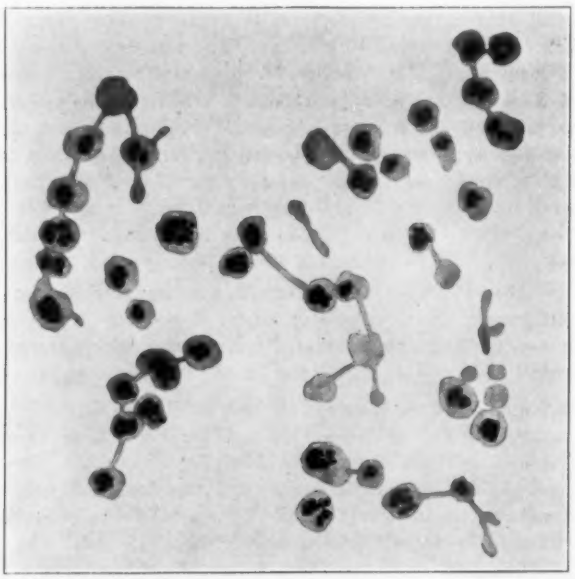

Fig. 2 (case 3).—Plain spores and spores with lobulated chromatin connected with rodlike projections. Smear; Giemsa stain; projection drawing; × 540.

12. Pus was obtained at all of the irrigations, in small amounts at first. The rheumatism cleared up after the fourth irrigation. On May 18, an intranasal drainage of the maxillary sinuses and a submucous resection of the septum were done.

Microscopic Examination.—Fungus forms were found in the stained smears from the left maxillary sinus on March 10, 14, 18, 22 and 31, and in those from the right maxillary sinus on April 14. These forms resembled Mucor-Histoides as to the two types of spores, one of which was plain and the other of which had lobulated chromatin. The hyphae differed from those of Mucor-Histoides in that they were more rudimentary, but spore buds of both kinds were present on them.

CASE 3.—A woman, aged 30, single, who had never had frequent colds or nasal trouble, had acute rhinitis beginning on Jan. 31, 1933. The temperature was 101.8 F. There were pain and swelling of the right cheek. Transillumination showed that the maxillary sinuses were dark, the left being the darker. The frontal sinuses were of moderate size, equal and clear. On January 31, the maxillary sinuses were irrigated, and thick pus was obtained from both. The maxillary sinuses also were washed on February 2, 4, 6, 8, 10, 13 and 17. On February 17, the return was clear from both sides.

Microscopic Examination.—Fungus forms which resembled those of Mucor-Histoides were found in the stained smears as follows: On January 31, histoid spores and rudimentary hyphae were found on the right side. On February 4, spores with rods and rudimentary histoid hyphae were found in the left maxillary sinus. The spores greatly predominated. On February 6, spore chains, with network and fans suggesting segmentation were found in the left maxillary sinus. On February 10, granular bodies with spores attached and chain spores and rudimentary hyphae were found in the left maxillary sinus. On February 13, spores and rudimentary hyphae were found on the right side, and a plain histoid spore chain with buds and a few rudimentary hyphae on the left. On February 17, hyphae were more numerous than spores on the left side.

CASE 4.—A woman, aged 32, married, first seen on Dec. 25, 1932, had a pain and swelling of the right cheek. She was in the fifth month of pregnancy. The right maxillary sinus was irrigated on December 26, and thick pus was returned. The right maxillary sinus was irrigated on December 28, January 5, 9, 13, 16, 20, 24 and 28 and February 6. On February 14, the fluid was returned clear. On Nov. 16, 1933, eleven months later, the patient had an acute inflammation of the maxillary sinuses. Pus was washed from both sides. Antral irrigations followed on November 18 and 21. A considerable amount of pus was obtained from both sides. On December 4 intranasal drainage of the maxillary sinuses was done. The patient was kept under observation until Feb. 19, 1934. At that time the maxillary sinuses were clear and in good condition.

Microscopic Examination.—The right maxillary sinus showed on Dec. 26, 1932, fungus forms similar to Mucor-Histoides occurring as spores in a chain arrangement with connecting rods in places, suggesting a filament. The spores were plain or associated with lobulated nuclei with yeastlike buds; there were occasional rudimentary hyphae. On December 28, much the same elements were present. On Jan. 25, 1933, the same elements were found, but there were fan forms suggesting segmentation. On January 13, histoid spore forms were present. On January 16, histoid spore forms and occasional hyphae were present. On Jan. 20 and 28, 1933, the right side showed histoid spore forms and occasional hyphae. On February 6, histoid spore forms, occasional hyphae and fairly abundant spore

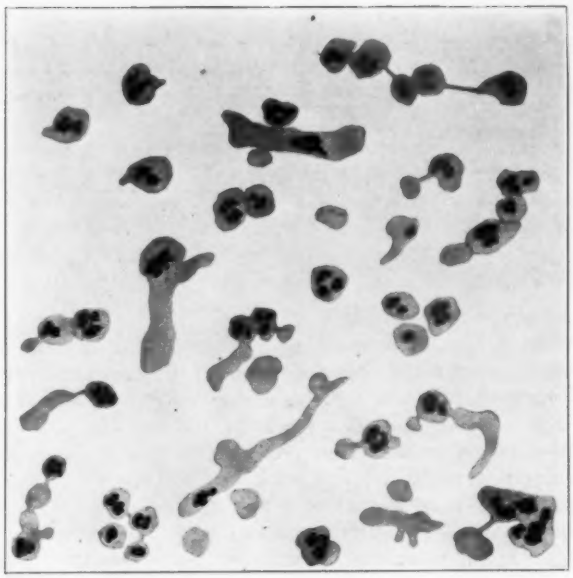

Fig. 3 (case 4).—Hyphae with masses of chromatin and well formed plain spore buds are shown. Smear; Giemsa stain; projection drawing; × 540.

Fig. 4 (case 5).—Field in which clumps of spores and atypical hyphae are seen. Smear; Giemsa stain; projection drawing; × 540.

forms were seen. On November 16, well defined hyphae and spores similar to the aforementioned forms were visible. On November 18, similar fungus forms were found.

CASE 5.—A boy, aged 16, first seen in October 1926, had received an injury to his larynx and vocal cords while playing football. He was next seen in June 1927, at which time the right maxillary sinus was dark to transillumination. There was a discharge in the nose, with fever. The right maxillary sinus was tender, and there was congestion in the left. The condition cleared up in about a week with intranasal treatment. The patient was next seen in December 1927, with an acute infection of the upper respiratory tract. Transillumination showed a definite shadow in the right maxillary sinus. The patient was again seen in March 1928 and again in May 1928. On May 15, the left maxillary sinus was irrigated, and pus was recovered. The return was clear on the fifth subsequent irrigation of the sinus. At operation in June 1928, a remnant of tonsil was removed, and a submucous resection of the septum was done. In October 1928, the patient had an acute infection of the upper respiratory tract, at which time the right antrum was darker than the left to transillumination. The maxillary sinuses became reinfected, and pus was washed from both sinuses in November 1928, and in January, February, July and December 1929. The patient then went to Arizona for two winters. In April 1933, he was seen with an acute infection of the upper respiratory tract. Irrigation of both maxillary sinuses was performed on April 27, and pus was obtained from both sides (right, 4+; left, 2+). Irrigations of the antrum were also done on April 29 and on May 2.

Microscopic Examination.—On April 27, 1933, fungus forms resembling Mucor-Histoides were present and showed rudimentary hyphae with buds and both kinds of spores. On April 29 and May 2 similar forms were found on both sides.

CASE 6.—A woman, aged 25, a school teacher, who had always been well, was first seen with an acute rhinitis in March 1927, at which time the sinuses were negative to transillumination. The infection cleared up within a few days. The patient was next seen in April 1930, when acute catarrhal otitis media was found on the left side. Transillumination at this time showed that the frontal and the maxillary sinuses were clear. In December 1931, the right maxillary sinus showed a slight shadow to transillumination. A slight nasal catarrh was present. In February 1932, the patient had acute laryngitis. A submucous resection for continued difficulty in nasal breathing and nasal catarrh was performed in March 1932. In November 1932, the patient began to have headaches. There were moderate shadows in the right and left maxillary sinuses. On December 10, the maxillary sinuses were irrigated, and pus was obtained from both. The sinuses were irrigated twelve times from December to March 1932. In April 1933, operation and intranasal drainage of the maxillary sinuses were carried out. The patient was under observation until May.

Microscopic Examination.—On Dec. 24, 1932, the following fungus forms were found in the right maxillary sinus: histoid spores in chain arrangement; plain spores and others with lobulated chromatin, with buds attached, and occasional rudimentary hyphae. These fungus forms were found with increasing frequency on both sides on the following dates: January 7, 14, 28 and 31, February 6, 11 and 18, and April 4 and 18.

CASE 7.—A married woman, aged 44, was first seen in November 1927, with an acute infection of the upper respiratory tract. In January 1928, she was again seen with an acute infection of the upper respiratory tract. The left maxillary sinus was dark to transillumination. In February 1933, there was pain in the

Fig. 5 (case 6).—Elongated hyphae with attached spores containing lobulated chromatin. The absence of partitions should be noted. Smear; Giemsa stain; projection drawing; × 540.

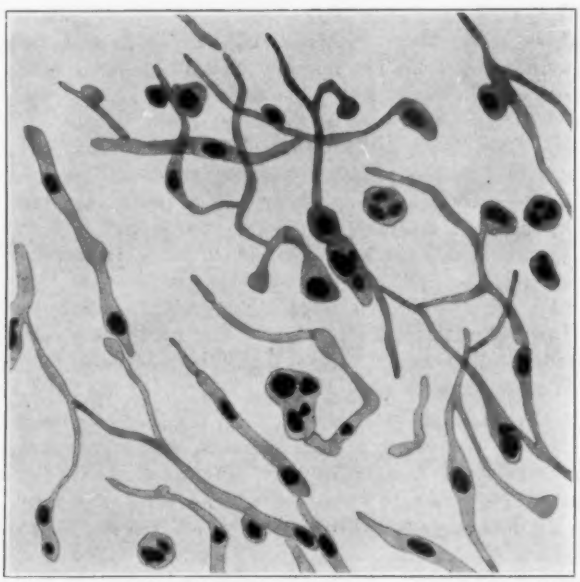

Fig. 6 (case 7).—Mycelial network showing fibers with spores attached. Large elongated cells are closely associated with the mycelial fibers. Smear; Giemsa stain; projection drawing; × 540.

left cheek, and the left maxillary sinus was dark to transillumination. The left frontal sinus was slightly dark. On February 28 the left antrum was washed and pus (2+) was obtained. The left maxillary sinus was irrigated on March 4, 7, 10, 15, 18 and 25, April 1, 10, 17 and 24, and May 1. In June there was an acute attack, and pus was washed from the left maxillary sinus. In November 1933, there was an acute recurrence, and pus was washed from the left maxillary sinus.

Microscopic Examination.—Pus from the left maxillary sinus showed the following: on February 28, histoid spores in chains and rudimentary hyphae, filament-like material, with an occasional spore attached, and plain spores; on March 10, small mucous flakes with chains of histoid spores and rudimentary hyphae; on March 18, histoid spores and rudimentary hyphae; on March 25, histoid spores and rudimentary hyphae and cell masses; on April 10, pigmented histoid hyphae, mononuclear cell masses, a mycelial network and histoid spores; on April 17, a mycelial network, no partitions, occasional nuclei, the suggestion of a foot cell and spores on the side of the mycelium, free and with mitotic figures. These gave rise to mycelium after growing to rather large cells—a complicated cycle; on November 1, rudimentary hyphae with buds and spores, both plain and with lobulated chromatin; the spores had buds; on November 3, definite histoid forms as aforementioned, and on November 10, the same forms as on November 3, with the addition of fan-shaped spores.

COMMENT

The cases reported had in common the facts that pus was present in the maxillary sinuses when they were irrigated, and that in this pus fungus forms were present. In gross appearance the pus returned was not different from that usually seen in infections of these sinuses. The characteristics of the fungus closely resembled those of Mucor-Histoides previously reported. One case showed, in addition to these forms, a well defined network of mycelial fibers. Such a network of fibers was not present in the fungus originally described or in the other cases of this series. Otherwise, the fungi had a definite similarity in their forms.

The presence of this mycelial network was of interest for two reasons: It could have been the manifestation of a different variety of fungus, or it could have been a form of growth of the same group of organisms brought out by certain growth factors and influences which the other cases did not have. The latter view has some support in that the original Mucor-Histoides showed a predominance of the growth of spores at one time and of the hyphae a little later on.

Cultural studies were not made of the cases reported here. A few specimens were submitted to the usual cultural examination for fungi, with negative results.

The clinical course of the infection was of interest in these cases. Six of them in which there was evident infection for some months prior to the first irrigation of the sinuses were classed as chronic infections. Of these six cases, four (1, 4, 5, 7) showed a definite recurrence of infection; the sinuses became acutely inflamed, were

cleared up by irrigation of the sinuses and then after months or years were reinfected. Two of the cases (4 and 7) showed the fungus forms not only in one infection but also in the subsequent reinfection which took place during the following fall. One case was that of a simple acute infection. There was nothing in the clinical picture of these cases in which fungus forms were found that was different from that of other cases of infection in these sinuses.

One of the chronic cases was of unusual interest because of the association of acute rheumatic manifestations with the infection of the sinuses. This case was classed as chronic because no acute symptoms of inflammation of the sinuses were present. Only a moderate catarrhal discharge was found in the nasal chamber. Irrigation of the maxillary sinuses showed a few shreds of mucopus. The rheumatic manifestations began to clear up after irrigation of the maxillary sinuses was instituted. A complete cure of this condition resulted after intranasal drainage of the maxillary sinuses, and there has been no recurrence of the sinus infection or of the rheumatism after a year.

In the original case of mucormycosis considerable interest was attached to the fact that the fungus infection in the maxillary sinus was associated with a precancerous lesion in the form of a chronic mastitis. No lesions of this nature have been encountered in the present series of cases. The association of the fungus forms in the maxillary sinuses with the rheumatic condition should, however, be borne in mind. Lesions in other portions of the body of unusual interest were not noted in the other cases.

Just what the etiologic relationship of the fungi herein described was to the inflammation in the sinuses should be discussed. The work presented here demonstrates their presence in the discharge from the sinus. They may have been present as the agent causing the active inflammation in the sinus, or they may have been present as saprophytes which had made their way into the sinus through the nasal passages. Their presence as saprophytes was understandable in the chronic cases, for a direct corollary has been found in the presence of saprophytic bacteria in these conditions. The presence of fungus forms in cases in which there had been acute recurrent infections was more difficult to explain on the saprophytic basis. If the fungus forms were there as saprophytes and if the naturally resistant nasal chamber and the usually sluggish nature of inflammatory changes caused in other parts of the body by fungi were considered, it would seem that they must have gained access to the sinus prior to the onset of the acute inflammation. This would imply a sinus in which a constant saprophytic infection with fungi existed.

The idea that the fungi were active agents in the inflammation gained support from the fact that fungus forms were found in the right and left maxillary sinuses in cases 1, 2, 3, 5 and 6. This seemed hard to explain on the basis of their being saprophytes. The conception of a pathologic state within the sinuses caused by the action of these fungi was also strengthened by the fact that two cases showed fungi in the succeeding infections. These two cases strongly suggested that the fungi were present in a more important rôle than that of simple saprophytes.

A state of infection with fungi constantly present would easily explain the type of sinus infections which give rise to an almost constant slight nasal catarrh and which from time to time have acute exacerbations. The acute exacerbations could be caused by a reduction in the general resistance of the body from exposure, excesses in diet, fatigue and similar factors which would create a condition favorable to the growth of the organisms in the sinuses. When environmental conditions became more favorable for the fungi, they grew and set up active inflammatory processes with resulting clinical signs.

A theory based on the constant presence of organisms of this type in the sinuses could easily account for many of the so-called colds in the head which seem to be so prevalent in the metropolitan districts.

Consideration should be given to the idea that the acute inflammation in the cases under discussion might be due to the invasion of the sinus by a fresh organism, possibly a bacterium, and to the resulting symbiotic growth of the fungi with the recent invader. If these fungi were present in the sinuses only as saprophytes, they were of considerable importance as precursors to the active inflammation.

It is of interest to note that Stovall and Bubloz [8] recently reported the recovery of fungi from two hundred and fifty cases of bronchitis, pneumonia, asthma, bronchiectasis, thrush and vaginitis. It would seem that fungi were more common in infections of the upper respiratory tract than has usually been supposed. Types of fungi found by them were Monilia, Oidium, Endomyces and Torula. They obtained therapeutic results by giving potassium iodide in doses up to 200 grains (12.96 Gm.) three times a day. Adams [2] gave this amount of the drug with good results in his case.

Treatment of the sinus infections described here has been of the usual type for infected maxillary sinuses. The local treatment consisted of a saline irrigation of the sinuses followed by antiseptic solutions. In many of the cases this treatment was effective. When drainage openings were made in the sinuses, the results were generally good. Supportive treatment directed toward building up the general resistance of the body

8. Stovall, W. D., and Bubloz, A. A.: Yeast-Like Fungi: Differential Characteristics and Case Reports, J. Lab. & Clin. Med. **18**:890 (June) 1933.

was given as a routine. Recourse was not had to the administration of such drugs as potassium iodide, owing largely to the fact that the smears were put aside and studied after treatment had been discontinued. Because of this the presence of the fungi during the time of treatment was usually not known.

Persistence in studying pus recovered from the sinuses by the methods outlined will undoubtedly reveal additional cases in which fungi are present in the sinuses. Improvement in the methods of staining and of culture will add to the ease with which the presence of the fungi can be made known. These improvements will be the foundation for increased effectiveness of systemic measures and of treatment applied directly to the sinuses.

SUMMARY

Seven cases of infection of the maxillary sinus in which fungus forms were found in the pus recovered from the sinuses have been reported. These fungus forms closely resembled those of Mucor-Histoides. Six of the cases were classed as chronic sinusitis. Four of the patients had recurrent infections while under observation, and in two patients fungus forms were also found in infections recurring after some months. In five cases the infection was bilateral. The observations indicated that fungi were present as active agents rather than as saprophytes. In one of the cases the infection was associated with acute rheumatic manifestations.

The recurrent infections suggested a theory which would account for the production of certain head colds.

THE SPHENOID SINUS

POSTOPERATIVE OBSERVATIONS FOLLOWING OPERATIONS ON THE ETHMOSPHENOID SINUSES

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This study is prompted by a certain amount of dissatisfaction with the results of operations on the ethmosphenoid sinuses and a consequent confusion, at times, as to the best method to be followed. The brilliant results reported by enthusiastic advocates of the external operation, such as Sewall,[1] Ferris Smith[2] and Simpson,[3] make one doubt the advisability of the intranasal procedure. Yet I am certain that many surgeons still prefer to operate intranasally, reserving the external approach for cases obviously demanding it. Often the patients prefer this method, agreeing to it when they would hestitate to accept an external operation. Earlier training, together with a natural desire to avoid subjecting the patient to more than is necessary, makes one try out the intranasal operation first. Indeed, the late Robert Lynch[4] in describing his external approach, said, "When all else fails, try this." Possibly his words have been misinterpreted as being a reference to the external operation as a last resort rather than a plea for a complete operation when, after study and treatment, operation has finally been deemed necessary. There is no doubt that the external procedure is more satisfactory in dealing thoroughly with the ethmoid cells. Referring to this, Ferris Smith[2] said, "The rhinologist frequently attempts to complete with postoperative treatments in his office that which he should have accomplished in the operating room." This probably accounts for the greater satisfaction afforded by the results following radical operations on the antrum. The inability to deal intranasally with the ethmosphenoid sinuses with a thoroughness approaching that observed when the antrum is dealt with through the canine fossa

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Read before the American Laryngological, Rhinological and Otological Society, Charleston, S. C., April 5, 1934.

1. Sewall, E. C.: External Operation on the Ethmosphenoid Frontal Group of Sinuses under Local Anesthesia, Arch. Otolaryng. **4**:377 (Nov.) 1926.

2. Smith, Ferris: Management of Chronic Sinus Disease, Arch. Otolaryng. **19**:157 (Feb.) 1934.

3. Simpson: External Ethmosphenofrontal Operation, Tr. Am. Laryng., Rhin. & Otol. Soc., 1933.

4. Lynch, discussion on Simpson-Saunders: External Ethmofrontal Operation, Tr. Am. Acad. Ophth., 1930, p. 453.

sometimes makes one hesitate to operate when conditions suggest it, and frequently to play safe when one does operate by leaving diseased tissue high in the nose.

The advantages of the external operation in making possible more thorough exenteration of the ethmoid cells are well understood, but less has been said regarding the results on the sphenoid sinus. In my experience these have too often been unsatisfactory. Are these poor results due to the limitations necessary with the intranasal operation? Most of the elder authorities considered the intranasal method quite satisfactory so far as the sphenoid sinus was concerned. On the other hand, Lynch [5] said that complete removal of the anterior wall and evisceration of the lining were possible only with the external approach. Barlow [6] called attention to the fact that one overlooked posterior ethmoid cell may keep up an infection in the sphenoid sinus. Sewall [7] said that inability to remove the floor of the sphenoid sinus completely interferes with the cure of that sinus. He believes that the procedure of making both sphenoid sinuses into one and removing their floors gives the best results. How many, though admitting the validity of these principles, carry them out as a routine measure? Is the failure to do so the cause of poor results, and are these sufficient in number and extent to warrant discarding the intranasal procedure, at least when a radical or, using Ferris Smith's suggested term, a complete operation is indicated?

This study is confined to postoperative observations solely on the sphenoid sinus following ethmosphenoidectomy. Results in the ethmoid region will be disregarded. Likewise the symptomatology, indications for operation and details of technic will not be considered.

As a result of these observations certain questions present themselves. It must be admitted that often the operative opening made in the anterior wall of the sphenoid sinus tends to close. Why does this take place? What is the nature of the closure? Does it occur more frequently with any certain type of case? What is the result to the patient?

From a perusal of the textbooks one is apt to get the impression that this tendency to closure after operation follows simple enlargement of the sphenoidal ostium. Hajek [8] stated that if the anterior wall, including the pars ethmoidalis, is completely removed there is reason-

5. Lynch: Ethmoidal Sinusitis: External Approach, Tr. Am. Acad. Ophth., 1921, p. 438.

6. Barlow, R. A.: Infection of the Sphenoid Sinus, Ann. Otol., Rhin. & Laryng. **37**:477, 1928.

7. Sewall, E. C.: General Surgical Principles Employed in Treatment of Chronic Disease of Nasal Sinuses, Ann. Otol., Rhin. & Laryng. **38**:995, 1929.

8. Hajek, M.: Nasal Accessory Sinuses, St. Louis, C. V. Mosby Company, 1926, vol. 2, p. 535.

able assurance of a wide permanent communication with the nasal cavity. At the same time he stresses the importance of after-treatment, because of the tendency of the opening to contract, and advises that the patient be under observation for at least six weeks, until cicatrization has taken place. Even this appears to be too conservative, as an opening which appeared satisfactory several weeks after operation may be found markedly contracted when seen a year later.

It is frequently difficult to follow patients for any considerable period after convalescence, especially if they come from more or less distant places, as is apt to be the case with those requiring radical operations. From those whom it has been possible to follow, as well as from certain others operated on elsewhere and who, by a change of residence, have come under my observation, there has been a growing amount of evidence that the condition of the sphenoidal opening becomes quite unsatisfactory in a large percentage. Following Tobey's [9] review of one hundred operations on the sinuses, presented to this society two years ago, a definite effort was made to follow up a similar number of consecutive radical operations on the sinuses. The patients have been seen at least at monthly intervals for from one to two years. In this series there were eighteen cases in which the sphenoid sinuses were opened in connection with operations on the ethmoid sinuses. This small number itself indicates the infrequency with which radical operation was attempted in this region, compared to the preponderance of cases in which radical operation was performed on the antrum. This is not quite accurate, however, as the sphenoid sinuses were not opened in all the operations on the ethmoid sinuses. Of the eighteen cases in which the anterior wall, including the pars ethmoidalis, was removed as completely as seemed possible it has been necessary to reopen the sinus in eight once or oftener, while in one other the opening, after having been in a satisfactory condition for a year, has recently contracted so as to make a reopening advisable. Thus in 50 per cent of the cases the postoperative results appear unsatisfatory.

One wonders whether these results may be accounted for by reason of poor operative technic. Admitting the imperfection of the operator, it cannot account entirely for these results. At least this fault is not peculiar to me. As stated before, postoperative observation of other patients, who came under my care by reason of a change of residence and who had been operated on by some of the recognized leaders of the profession showed similar findings in sufficient number to justify the belief that the result is not a question of technic alone.

Various methods of after-treatment have been tried with rather indifferent success. During the immediate convalescence granulations

9. Tobey: End Results of One Hundred Consecutive Sinus Operations, Tr. Am. Laryng., Rhin. & Otol. Soc., 1932, p. 72.

can be removed and silver nitrate or trichloracetic acid applied, but it is the later period which seems difficult to control; in this, in certain cases, there seems to be a constant gradual tendency to reformation of the anterior wall. Caustics are of little avail. Roentgen therapy has been of little use in my hands. Radium, as suggested by Barlow, has not been tried. For a time I endeavored to control the process by the use of electrocoagulation, but the ultimate results were even worse. Reoperation seems to be the only way to restore the operative opening in the cases in which it tends to close.

What causes this tendency of the anterior wall of the sphenoid sinus to reform? Goldsmith [10] in a discussion of Sauer's paper on "End Results of Sinus Surgery" said that "if a cavity which was not intended by Nature to have a large inlet, or outlet, is widely opened, the mucous membrane will resent it." Perhaps this resentment may ultimately be manifested by reformation of the anterior wall. One knows how often even a large intranasal opening made into the antrum will eventually become closed. Nature tends to restore the original plan. With the frequent asymmetry, the unevenness of osseous edges and the tags of mucous membrane bound to remain after an operation in this region, it appears that reformation of the anterior wall might easily take place.

While specimens removed from patients requiring reoperation have shown pathologic changes, as might be expected, layers of well formed epithelium and the presence of numerous glands in the stroma seem to indicate that this tissue, which sometimes tends to close the previously opened sphenoid sinus, is mucous membrane growing from the septum, from the edge of the floor of the sinus and from remnants in the ethmoid region. Some of the specimens show considerable fibrous tissue. Some areas are heavily infiltrated with lymphocytes, in places almost resembling lymph nodules. Other areas show edematous changes. Of course these findings are characteristic of chronic inflammation of the nasal mucous membrane, as given by Schall,[11] and are due to the presence of a sinusitis. It seems possible that the condition might be analogous to the closure of an intranasal antral opening, an attempt on the part of nature to reform the anterior sphenoidal wall.

It has been especially noticeable that postoperative contracture is more apt to take place in a small shallow sphenoid sinus. This is especially so if there is marked asymmetry. The larger sinus usually remains open while the smaller one tends to close. In one of these cases

10. Goldsmith, discussion on Sauer: End Results Following Operations for Chronic Sinus Disease, Tr. Am. Laryng., Rhin. & Otol. Soc., 1921, p. 253.

11. Schall: Histology and Chronic Inflammation of Nasal Mucous Membrane, Tr. Am. Acad. Ophth., 1932, p. 395.

in which the sphenoid had resisted efforts to maintain a wide opening on the side of the smaller sinus, the desired result was finally obtained by removing the posterior portion of the nasal septum together with the crest of the sphenoid, and making both sinuses into one, following the procedure described by Watson-Williams [12] and by Colver.[13] It also seems that there is a greater tendency for contracture in the allergic type of patients. Six of the persons on whom it was necessary to reoperate were definitely allergic. Lest I be criticized by some for subjecting these patients to operation, let me say that they were all

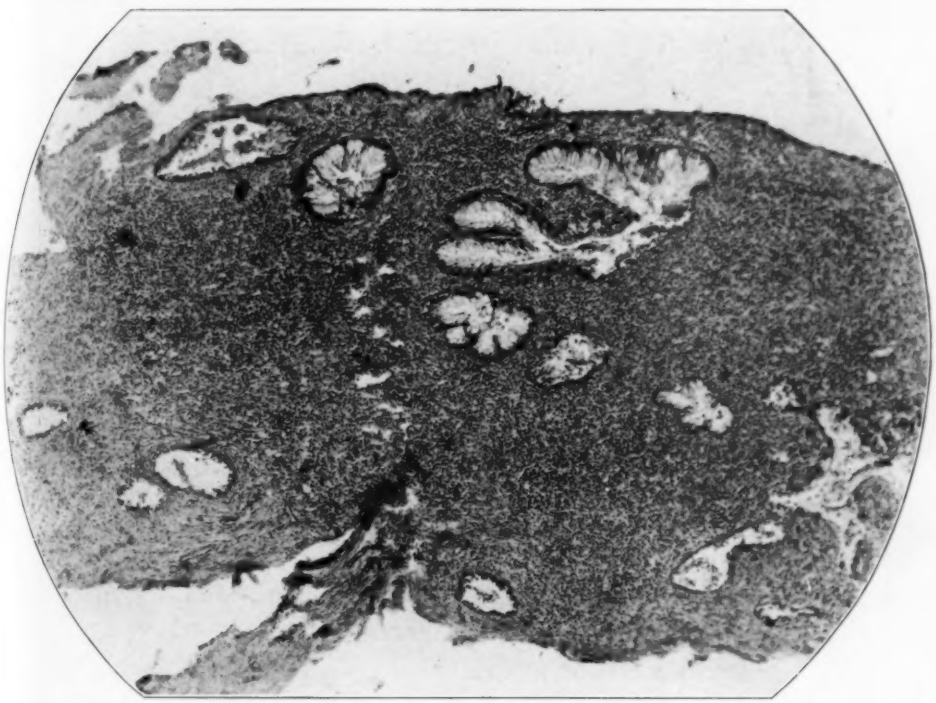

Fig. 1.—Marked lymphocytic infiltration about numerous glands. Specimen from reformed anterior sphenoidal wall; reduced from × 60.

carefully studied for a considerable time and consistently treated from the allergic point of view, and that operation was undertaken only when it seemed obviously necessary. Most of the cases in which the operative openings have remained the widest over a long period have been of the chronic purulent type.

12. Watson-Williams, Patrick: Chronic Nasal Sinusitis, New York, William Wood & Company, 1930.

13. Colver: Certain Observations in Relation to the Surgery of the Sphenoid Sinus, Tr. Am. Laryng., Rhin. & Otol. Soc., 1921, p. 106.

What is the result of this contracture to the patient? If one examines patients who present the contracture but in whom there is no active sinusitis one finds that they are quite comfortable; possibly more so, at least in severe cold weather, than those with wide-open sphenoid sinuses. This does not hold true for those in whom there is any activity in the sinuses or in whom there are any underlying factors that have not been taken care of. Under these circumstances, with a reformed anterior wall and the same factors causing a recurrence of the sinusitis, reoperation is required to secure ventilation and drainage. The contracted opening does not suffice. In fact, complete closure of the

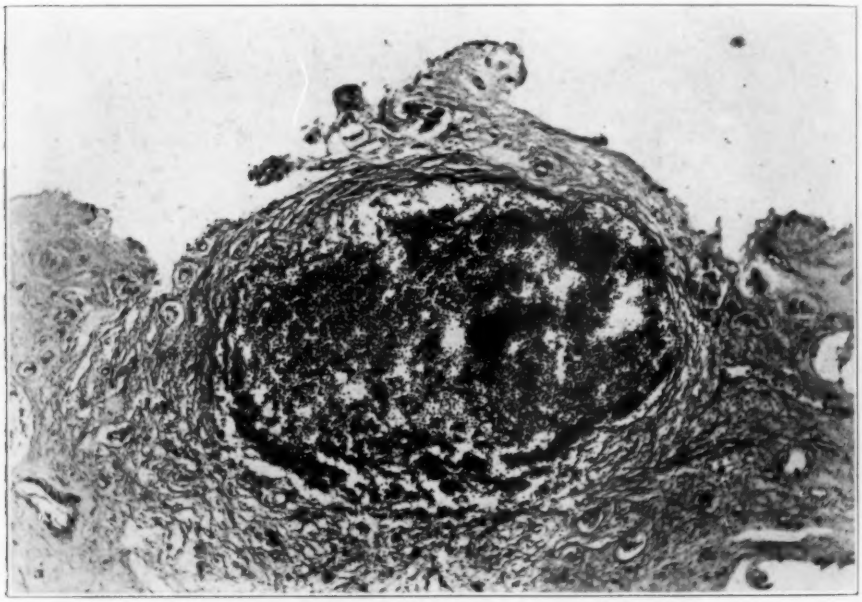

Fig. 2.—Lymph nodule in reformed anterior wall. Edematous changes in stroma, noted especially below the nodule; reduced from × 95.

sinus and development of a pyocele may occur, as in one case of this series. The symptoms complained of by the patients requiring reoperation were postnasal discharge and cough, nasal obstruction, headache and, in the allergic patients, asthma. In all, reoperation finally resulted in relief from these symptoms.

Especially interesting has been the response in the allergic patients, in whom marked improvement in the allergic manifestations followed and continued as long as the sphenoid sinus remained open. Environmental factors, foods to which they were sensitive, dietary errors and endocrine imbalances had been eliminated so far as possible. The antrums had previously been operated on radically. Exacerbation of

the allergic symptoms seemed definitely linked with closure of the sphenoid sinus. Sewall [14] stated that if allergy is a predisposing cause of sinusitis it is through interference with drainage. Ferris Smith [15] found that the sphenoid sinus was frequently an etiologic factor in allergy, while the frontal sinus was involved only occasionally. The difference in the normal drainage between these sinuses may be a reason. Cultures from the secretion found in the reopened sinuses have shown the usual variety of bacteria, with streptococci, staphylococci and Micrococcus catarrhalis predominating. Cutaneous tests for these organisms have been almost uniformly negative. It might be said that

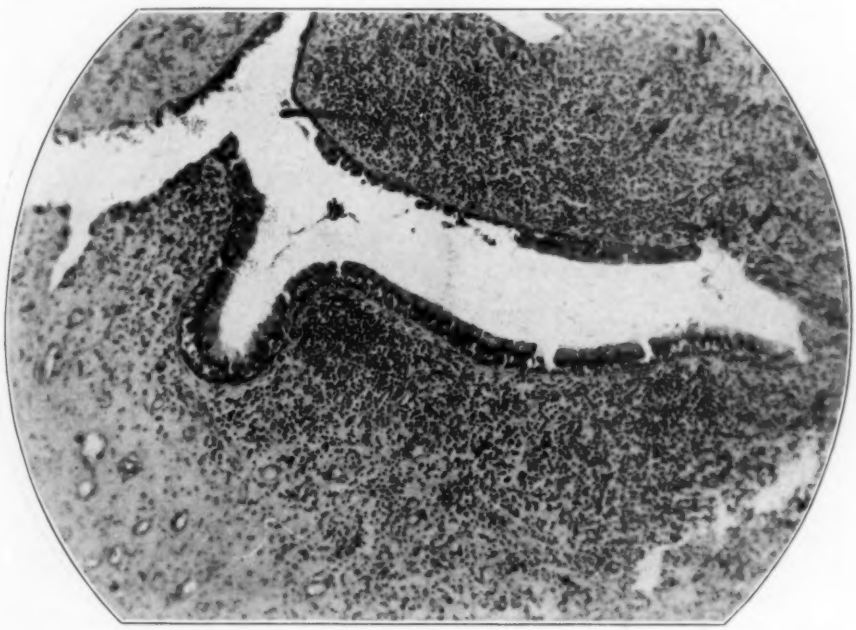

Fig. 3.—Ciliated columnar epithelium from reformed anterior sphenoidal wall; reduced from × 130.

the patients who seem improved by operation might be as well benefited simply by a stay in the hospital or by any similar change of environment, but they were all under observation in the hospital for a considerable time before operation, and the allergic symptoms persisted until the sinus was opened. This sequence of return of allergic manifestations and closure of the sphenoid sinus, followed by relief of symptoms on reopening the sinus, has occurred so frequently as to be

14. Sewall, in discussion on Simpson.[3]

15. Smith, Ferris: Asthma: Its Etiology and Surgical Treatment, Ann. Otol., Rhin. & Laryng. **38**:1095, 1929.

of some significance. One may consider this as a condition of bacterial sensitization. I do not mean to imply that the sphenoid sinus is the sole factor in these cases. Blocking of any sinus may cause the same reaction. But, as has been said before, the sphenoid sinus is a frequent etiologic factor in allergy and is especially prone to postoperative contracture.

There is a great difference of opinion as to the advisability of surgical procedure on the sinuses in allergic patients. Ferris Smith

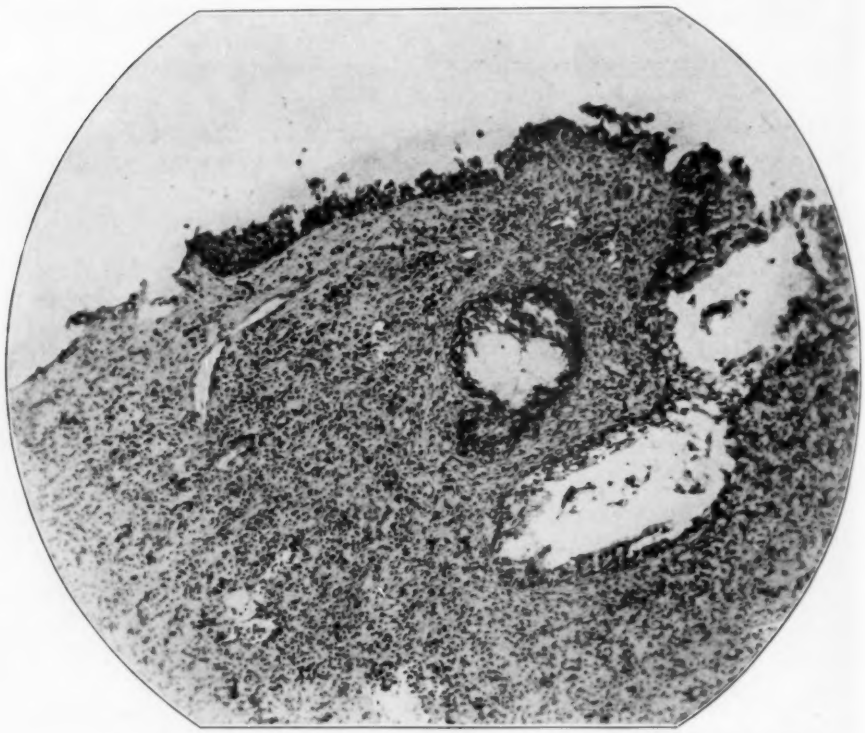

Fig. 4.—Pseudostratified epithelium from reformed anterior sphenoidal wall; marked periglandular infiltration; reduced from × 110.

believes that from 70 to 80 per cent of patients with asthma can be cured by complete removal of all infection in the sinuses, if it is possible to accomplish this. Hansel,[16] on the other hand, thinks that in these cases surgical intervention should be extremely conservative, and that the allergy must be controlled if satisfactory results are to be obtained. But often, owing to secondary infections, pathologic changes occur in

16. Hansel: Diagnosis and Treatment of Allergic Disease of the Nose and Para-Nasal Sinuses, Tr. Am. Acad. Ophth., 1930, p. 350.

the sinuses and demand operation. I believe that surgical measures are advisable only when definite indications, independent of the allergy, are present in the sinuses themselves. Tobey [17] considers the external route the operation of choice when exenteration of the ethmoid sinuses is indicated.

One of the patients requiring reoperation had been operated on externally, but the floor had not been removed and the two sinuses had not been made into one, as recommended by Sewall. Complete removal of the floor is not always easily accomplished, owing to the density of the bone, and it is doubtful if every one not endowed with the skill of Sewall would attempt this as a routine measure. With the external approach, however, this goal should be more nearly attained, and failure can be rightfully attributed to poor technic. At the same time two other patients in the series operated on externally but with far from complete removal of the floor have been free from symptoms.

Evidently failure to maintain adequate drainage from the sphenoid sinus is a frequent cause of poor results. Whether these poor results are sufficient in number and severity to warrant discarding the intranasal approach to the sphenoid sinus in every case I am not prepared to say. In some cases obviously the external approach should be used. In some others it may seem worth while to try intranasal methods. Each case must be a law unto itself, and individual indications should determine the proper procedure. The matter seems to resolve itself into this: One will get satisfactory results in probably 50 per cent of the cases with the intranasal method; in the other 50 per cent secondary procedures may be required following the intranasal operation. On the whole, owing to the disadvantages of secondary operations, patients on whom they are required would be better off if the external operation were performed. Yet the secondary procedures are simple and may be preferable in certain cases. On the other hand, the external operation seems definitely indicated in allergic cases in which, after a careful study, operation on the ethmosphenoid sinuses appears warranted. Likewise in patients with a marked difference in size between the two sphenoid sinuses, one sinus being small and shallow, the external operation, or at least the removal of the crest and making the sinuses into one cavity, seems advisable.

CONCLUSIONS

1. Subsequent contracture of the operative opening may occur following sphenoidectomy and nullify the effect of the operation, even

17. Rackemann and Tobey: The Nose and Throat in Asthma, Tr. Am. Laryng., Rhin. & Otol. Soc., 1929, p. 258.

after complete removal of the anterior wall, including the pars ethmoidalis.

2. This contracture is caused by a reformation of the anterior wall in an effort on the part of nature to replace the original structures.

3. This is more apt to occur in cases of marked asymmetry and with the smaller sinus. It also occurs more frequently in allergic patients.

4. With recurrence of the sinusitis, because of underlying factors, this contracture produces distressing symptoms. In the allergic patient it may be associated with a return of the allergic manifestations, which may again disappear following reopening of the sinus. It is important to try to control the underlying factors, if possible, and, at the same time, observe the condition of the sinus, as they may form a vicious cycle.

5. Intranasal operation may necessitate reoperation on the sphenoid sinus in 50 per cent of the cases, owing to limitations in the approach. Failure to maintain adequate drainage is a frequent cause of poor results. Complete operation, as is possible with the external approach, would probably more closely approximate the results obtained from radical surgical procedure on the antrum.

SUPRAGLOTTIC TUMORS

METHODS OF TREATMENT AND ILLUSTRATIVE CASES

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Interest in tumors of the supraglottic portion of the larynx and of the laryngopharynx has been stimulated in recent years largely as a result of the work of Trotter.[1] His comprehensive reports of the surgical treatment of these tumors are outstanding. As a result of this pioneer work an attempt has been made at the Mayo Clinic to avoid some of the obvious pitfalls in dealing with this group of tumors, and, in some cases, methods of approach and removal other than those commonly prescribed have been resorted to. This report is not presented as a statistical study but rather with the purpose of reviewing therapeutic measures of value in these cases and of emphasizing methods of approach and of treatment the usefulness of which is not generally appreciated.

Tumors in the supraglottic portion of the larynx occur rather infrequently as compared with the number of growths in the remainder of the larynx; they are encountered often enough, however, to be of considerable clinical importance. Aside from multiple papillomas and cysts of the epiglottis, practically all are malignant. As has been observed previously, most tumors in the supraglottic portion of the larynx, particularly those originating in the epiglottis, occur among men, although one of the most extensive primary carcinomas of the epiglottis coming under my observation occurred in a woman 58 years of age.

Between Jan. 1, 1925, and Jan. 1, 1934, a total of 539 patients with malignant tumor of the larynx were examined at the Mayo Clinic. Approximately 20 of the tumors developed above the glottis, and all but 1 of the patients were men. The patients with supraglottic laryngeal tumor ranged in age from 40 to 79 years. Most of the growths originated in the epiglottis and secondarily involved the aryepiglottic folds, a few being primary in the latter situation. In several instances the site of origin was on the posterior or posterolateral aspect of the arytenoid cartilages. In one case the tumor originated in the floor of the

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From the Section on Laryngology, Oral and Plastic Surgery, the Mayo Clinic.
Read before the American Laryngological Association, Cleveland, June 8, 1934.

1. Trotter, Wilfred: Operations for Malignant Disease of the Pharynx, Brit. J. Surg. **16**:485 (Jan.) 1929; Some Principles in Surgery of the Pharynx, Lancet **2**:833 (Oct. 17) 1931; Malignant Diseases of the Hypopharynx and Its Treatment by Excision, Brit. M. J. **1**:510 (March 19) 1932.

laryngeal ventricle and in another in the aryepiglottic and glosso-epiglottic folds.

Malignant tumors developing in the epiglottis spring more commonly from the posterior aspect, nearer the tip. They are usually fungating rather than infiltrating, often appearing as cauliflower-like masses. Although they generally have sessile attachments, they may be pedunculated. There is, as a rule, little infiltration about the base; this accounts for the fact that treatment is effective in eradicating the lesion in a high percentage of cases even when the growth is apparently advanced. Although the tumor may be so large as to fill almost completely the lower portion of the hypopharynx and entirely to obscure a view of the larynx on either direct or indirect inspection, it is at times limited to the epiglottis. In such cases a satisfactory examination often necessitates thorough cocainization of the hypopharynx and larynx and retraction of the growth with a laryngeal applicator. Surgical removal without sacrificing the larynx is frequently possible even in many cases in which the growth is extensive.

Although supraglottic tumors are almost exclusively squamous cell epitheliomas of low grade and metastasize late, exceptions to this rule were noted in a number of cases in this group. Two lesions originating on the posterior aspect of the epiglottis proved to be hemangio-endotheliomas, grade 1, whereas one developing in the right aryepiglottic and lateral glosso-epiglottic folds and another arising from the floor of the laryngeal ventricle were low grade fibrosarcomas. In several instances epitheliomas of the epiglottis were of grade 3. Metastasis to the cervical lymph nodes took place quite early in one case of squamous cell epithelioma of the epiglottis of grade 2. In only one of the remaining cases of epithelioma of the epiglottis was metastasis encountered and, in this instance, it occurred late in the course of the disease.

It is of interest to note that in two cases of squamous cell epithelioma originating in the base of the tongue and secondarily involving the epiglottis the lesions were extremely active clinically and, microscopically, were classified as grade 4. There was such extensive involvement of the larynx in both of these cases that laryngectomy, together with resection of a portion of the base of the tongue, was required. These tumors are not included in the present report because of their site of origin.

As a rule tumors primary in the upper portion of the larynx produce symptoms later than those originating on the vocal cords, since there is less prompt interference with function and such growths are, as a result, almost invariably farther advanced at the time the patients come under observation. Although symptoms apparently develop promptly in some of these cases, they are often so mild in the early stages of the growth that they occasion little concern. The most common early subjective changes are irritation low in the throat and a sensation as of a foreign

body in that region. Cough and soreness or pain, particularly on swallowing, are also present. Later a sense of fulness in the hypopharynx and difficulty in swallowing develop. As the tumor extends it may involve the vocal cords, producing hoarseness, or with an increase in the size of the growth the voice may become full and guttural and dyspnea may result from obstruction of the superior aperture of the larynx. Spilling of fluids over into the glottis may be the chief feature of the dysphagia, and the cough may be due more to this than to actual irritation by the tumor. At times, dysphagia results in considerable loss of weight. Hemoptysis occurs infrequently and is usually not seen until late in the course of the disease. There is more likely to be only a slight streaking of the expelled mucus with blood rather than frank hemorrhage. The appearance of a palpable mass in the neck is also a late occurrence.

The diagnosis of tumors of the supraglottic portion of the larynx is, as a rule, readily established. The history and the clinical examination should strongly suggest the nature of the lesion. Benign tumors occurring in this region are, as a general rule, easily excluded, and although on examination with the laryngeal mirror the appearance of these growths is usually characteristic, at times it may be indistinguishable from that presented by syphilis or by tuberculosis in these parts. In addition to complete general physical examination and laboratory studies, including roentgenograms of the thorax and serologic examination for syphilis, a biopsy should always be done prior to instituting treatment. It is the practice at the clinic to do this in the office on the day preceding the anticipated treatment, using local anesthesia and indirect laryngoscopy. A report on the microscopic examination of a fresh frozen section is, as a rule, returned within the course of half an hour, although at times a further study of fixed sections is necessary for a definite diagnosis. In case the tumor is of sufficient size to make tracheotomy appear advisable prior to carrying out radical treatment, this should be done before securing a specimen for biopsy in order to avoid undue delay between the time of taking the specimen and of actually removing the neoplasm. Although I never have seen any evidence of harm following a biopsy performed without excessive trauma, it is conceivable that delaying treatment for a few weeks after that procedure, however carefully performed, may result in some activation of the growth and in increased likelihood of metastasis.

A number of therapeutic procedures are available for the treatment of malignant tumors of the supraglottic portion of the larynx. These differ both in the method of securing access to the lesion and in the means of its actual removal. The various types of pharyngotomy, with or without preliminary tracheotomy, have been in the past and still

remain the most satisfactory means of exposing these growths in the majority of cases. Laryngofissure, splitting the lower lip, mandible and tongue in the median line, indirect laryngoscopy, laryngeal suspension and other forms of direct laryngoscopy are useful in selected cases. Following exposure the tumor may be taken care of by excision, cauterization, electrocoagulation or irradiation. The procedures mentioned vary greatly in their comparative safety and ease of performance and in their effectiveness in eradicating the growth.

In 1918 Worthington [2] presented before the Royal Society of Medicine a man, aged 44, whom he had treated a few months previously with diathermy for an epithelioma involving half of the epiglottis and the right aryepiglottic fold. At the same time Mollison [3] cited a case in which a similar lesion, which extended into the base of the tongue, had recently been excised by him with the cautery; he had used laryngeal suspension. This method of treatment in such cases apparently did not become popular, for I am able to find only one other reference to it in the literature.

In the past few years a modification of these procedures has been used in the clinic in the treatment of a group of malignant tumors of the epiglottis and of the remainder of the supraglottic portion of the larynx. In some of these cases laryngeal suspension with the Lynch apparatus was applied, and, under direct observation, the neoplasm in the upper portion of the larynx was widely destroyed by electrocoagulation. In such cases a special short, broad spatula is used for retracting the tongue (fig. 1). This slips well down over the base, rather than onto the posterior aspect of the epiglottis as in the usual laryngeal suspension, and by retracting the tongue it affords an excellent view of the entire epiglottis. Thorough electrocoagulation of the lesion can then be carried out and, if deemed advisable, radium needles can be implanted into the coagulated region. This treatment has at times been supplemented with irradiation externally over the neck.

During the process of coagulation it is essential that an aspirating tube be held immediately adjacent to the point of the electrode, but not in contact with it. This carries away the escaping steam and vapor which otherwise would scald the tissues of the hypopharynx and obscure the view of the operative field.

The time required for coagulation varies with the size of the tumor, its vascularity and the dryness of the field. A sufficiently large dose of atropine to insure temporary inactivity of the mucous glands is of

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2. Worthington, R. A.: Case of Epithelioma of the Epiglottis Treated by Diathermy, Proc. Roy. Soc. Med. (Sect. Laryng.) **12**:158, 1919.

3. Mollison, W. M.: Discussion, Proc. Roy. Soc. Med. (Sect. Laryng.) **12**:158, 1919.

decided advantage. Although this method of treatment may be carried out effectively in some cases for the removal of small epitheliomas about the vocal cords, I have not felt justified in resorting to it for this purpose. The frequency with which such lesions extend downward onto the shelving under surface of the vocal cords where they cannot be visualized from above, together with the persistent spasm of the glottis encountered at times during suspension even under deep anesthesia,

Fig. 1.—Short, broad spatula used to retract the tongue and expose the epiglottis shown with that employed in the usual laryngeal suspension.

unnecessarily increases the hazard of recurrence, in view of the facility and certainty with which such tumors can be removed through laryngofissure.

If the lesion under consideration is extensive, preliminary tracheotomy is advisable because of the possibility of sufficient edema developing postoperatively to produce respiratory obstruction. The local reaction following this is permitted to subside before treatment of the tumor is undertaken. This requires about two weeks. General anesthesia is

necessary for suspension, ether supplemented with nitrous oxide and carbon dioxide being used for the purpose. The tracheal cannula is used, and ether is withheld during the time diathermy is actually in use.

The risk associated with this procedure appears to be slight; there has been very little immediate postoperative reaction in cases in which it was used, and convalescence has been surprisingly mild and brief. As there is practically no trauma to the tissues, aside from that due directly to the coagulating process, this is, of course, to be expected. Approximately two and a half to three weeks are required for separation of the slough, and healing takes place promptly afterward. Pulmonary complications have not resulted from aspiration of the slough, and postoperative hemorrhage has not occurred in any of the cases in which this method of treatment was used.

The functional results have been satisfactory in all cases, and there has been no impairment of the voice or difficulty in swallowing, as might be anticipated following complete removal of the epiglottis together with a portion of the aryepiglottic folds. Although some of the tumors taken care of in this manner were large fungating carcinomas that filled the entire lower portion of the hypopharynx and completely obscured the view of the larynx, in none of the cases in which patients were followed has there been any evidence of recurrence to date. The periods since operation now range up to three years.

REPORT OF CASES

CASE 1.—A woman, aged 58, was referred for examination by the physician at her home on Nov. 3, 1931, because of a growth in her throat. For twelve or fifteen years she had had difficulty in swallowing. Meat and other solid foods seemed to lodge in her throat. In the year prior to admission she had noted a sense of fulness in the throat, as if a foreign object were present. She had had some hoarseness for six months, and a few weeks before admission she had noted the appearance of dyspnea, particularly on lying down. She had lost weight and ascribed this to her inability to eat certain foods. A carcinoma of the left breast had been removed a little more than a year previously.

Examination revealed a typical epithelioma, approximately 3 cm. in diameter, involving the epiglottis and apparently limited to it. The growth completely concealed the larynx, with the exception of the posterior portion of the arytenoid cartilages (fig. 2). There were no palpable cervical lymph nodes. The general physical examination otherwise gave negative results except for a questionable lesion in the left lung which was thought to be bronchiectasis. A microscopic section of tissue previously removed from the throat was brought by the patient, and it proved to be squamous cell epithelioma, grade 3. Further examination of the throat following thorough cocainization revealed that the tumor was limited to the epiglottis and to the anterior portion of the aryepiglottic folds and that it was freely movable.

The trachea was opened under local anesthesia on November 6. An acute infection of the upper portion of the respiratory tract developed following this, and accordingly the second stage of the operation was delayed for a month. During

this period treatment with radium was given over the neck. The operation to remove the growth was performed on December 5, with the patient under intratracheal anesthesia. With laryngeal suspension by means of the Lynch apparatus wide coagulation was effected, and the charred mass was then removed by sharp

Fig. 2.—Epithelioma involving the entire epiglottis and completely obscuring a view of the larynx.

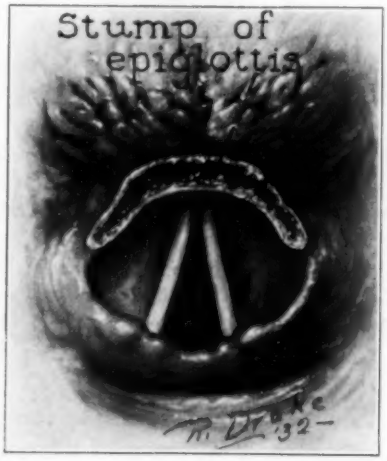

Fig. 3.—Stump of epiglottis following the removal of an epithelioma with diathermy, using laryngeal suspension.

excision. The wound in the throat was almost completely healed at the time of dismissal twenty-three days later (fig. 3). When last examined at the clinic, about a year later, the patient was in excellent general health. She had gained 10 pounds (4.5 Kg.); there was no evidence of recurrence of the epithelioma or any complaint referable to the throat aside from a slight drawing sensation on swallowing.

A recent examination by the laryngologist at the patient's home did not reveal a recurrence of the tumor.

Case 2.—A man, aged 64, was seen at the clinic on June 29, 1933, because of dysphagia and slight hemoptysis. Dysphagia had been present for a year, and had progressed to the point of making swallowing painful; solid food could not be taken without liquids to wash it down. In spite of this, however, the patient had not lost weight. There had been no change in the voice.

Physical examination gave entirely normal results except for the presence of a pedunculated, nodular, deeply pigmented tumor, a little more than 1.5 cm. in diameter, attached to the posterolateral aspect of the right arytenoid cartilage (fig. 4). The appearance of this growth suggested either an angioma, with recent hemorrhage, or a melano-epithelioma. A preliminary tracheotomy was performed on July 1, and, on July 20, under avertin (by rectum) and intratracheal anesthesia, laryngeal suspension with the Lynch apparatus was applied and a polyp snare slipped about the tumor. After the pedicle had been widely coagulated the growth was removed. Microscopically it proved to be a highly malignant, mixed adenocarcinoma and squamous cell carcinoma, grade 4. Because of the activity of the tumor, treatment with roentgen rays was advised as a supplementary measure, but

Fig. 4.—Pedunculated adenocarcinoma and squamous cell carcinoma, grade 4, springing from the posterolateral aspect of the left arytenoid cartilage.

this was refused by the patient. The tracheal tube was removed, and the patient returned home on the twelfth day. Ten and a half months later a letter from the physician at the patient's home stated that there was no evidence of recurrence.

The procedure naturally has a limited field of usefulness, for it is applicable only in cases in which the limits of the lesion can be definitely made out on inspection from above. Although it is well to restrict its use largely to cases in which lesions are inactive, it has been applied satisfactorily in cases in which there were active but well localized growths on the arytenoid cartilages, as in the foregoing case. It was attempted in several other cases of tumor of the epiglottis, but it failed to give sufficiently satisfactory exposure of the lesion, as the large, flaccid tongue tended to roll out beneath either edge of the spatula and fold over its exposed surface. Accordingly, in these cases, it was necessary to abandon the procedure and to perform a pharyngotomy.

Case 3.—A man, aged 62, came to the clinic on Feb. 6, 1925, because of pain and swelling of the left arm of three and a half years' duration. At an exploratory operation three years prior to admission, a tumor of the left humerus had been reported as "sarcoma."

On examination at the clinic, the growth proved to be a giant cell tumor, and treatment with roentgen rays was advised. Because of hoarseness the patient was referred to the section on laryngology for consideration. He stated that the hoarseness had developed following an abscess of the throat two years previously. He made no other complaint referable to the throat. Examination revealed an apparently pedunculated, mamillated hemangioma, about 1.5 cm. in diameter, on the posterior aspect of the left side of the epiglottis, and a few angiomatous areas over the tip of the epiglottis. As there were no symptoms aside from slight hoarseness, treatment was not advised.

The patient returned eight weeks later complaining of some difficulty in swallowing and of a burning sensation in the hypopharynx. The tumor had more than doubled in size, and some acute inflammatory reaction appeared to be present. Following subsidence of this a specimen for biopsy was removed; this was reported to be hemangio-endothelioma, grade 1 (fig. 5). On April 17 the tumor was removed through the Hasslinger directoscope, with the patient under local anesthesia. Following sharp excision, thorough coagulation of the pedicle of the tumor was carried out. Two weeks later screened radium on an applicator was applied to the wound in the epiglottis. The tumor had not recurred at the time the patient was last seen, nine months later; since that time he has not replied to letters of inquiry.

Fig. 5.—Hemangio-endothelioma of the epiglottis removed through the Hasslinger directoscope.

At the clinic, indirect laryngoscopy is used almost entirely among adults for the removal of localized, benign laryngeal tumors. Provided the patient is cooperative and the larynx well cocainized, it is possible to carry out rather extensive procedures in this manner quite as satisfactorily as with a laryngeal suspension. Although it is rarely justifiable to undertake the removal of malignant laryngeal lesions by means of indirect laryngoscopy, the patient's inability to finance hospitalization may at times necessitate that form of treatment, since this procedure can be carried out in the office. However, unless the growth is inactive and well localized, so that its extent can definitely be ascertained in advance, and unless the operator is accustomed to carry out intralaryngeal procedures by the indirect method, it is not advisable to attempt removal in this way.

Case 4.—A man, aged 40, presented himself for examination on Sept. 22, 1930, complaining of a sense of tightness in the throat and of a numb feeling in the left side of the throat. He had undergone thyroidectomy elsewhere four years pre-

viously for what had been diagnosed as exophthalmic goiter. At the time of the operation examination had revealed the presence of a tumor in the larynx, and it was primarily for investigation of this growth that he had come to the clinic. The patient cleared his throat frequently, but he had no hoarseness or cough.

At this time examination revealed a nonulcerated, benign appearing, nodular tumor, measuring 1.5 by 1.5 by 2 cm. on the posterior aspect of the epiglottis (fig. 6). The general physical examination and laboratory studies otherwise gave normal results. A specimen removed for biopsy from the lesion on the epiglottis was reported to be hemangio-endothelioma, grade 1. Because of the low degree of malignancy of the tumor and the patient's limited finances, removal in the office by indirect laryngoscopy, using local anesthesia, was attempted. This was unsuccessful because of the patient's inability to cooperate, and pharyngotomy was planned. The patient, however, insisted on another attempt at removal in the office, and, after preliminary administration of morphine, satisfactory electrocoagulation of the tumor was carried out on October 20. The wound healed in about two months, and at the last observation fifteen and a half months later there was no suggestion of recurrence.

Fig. 6.—Hemangio-endothelioma of the epiglottis removed by electrocoagulation, using indirect laryngoscopy.

The usefulness of the foregoing methods of treatment in removal of malignant tumors of the supraglottic portion of the larynx is limited to a comparatively small group of these lesions. Generally speaking, when such growths are infiltrating rather than fungating or pedunculated, when they are highly malignant or when there is extension beyond the epiglottis, an open operation, either pharyngotomy or laryngofissure, is advisable. Laryngofissure affords an excellent exposure of tumors situated laterally or posteriorly above the vocal cords, but confined within the larynx. Pharyngotomy, however, is the most universally satisfactory method of approaching the majority of these lesions, as it usually affords the best possible view, which is the basis of successful removal. Choice between subhyoid and transthyroid pharyngotomy depends on the situation and extent of the lesion. Tumors which involve the epiglottis and extend posteriorly along the aryepiglottic folds and laterally into the pyriform fossae are better visualized through a subhyoid approach, by incising transversely at the base of the tongue and drawing the epiglottis out into the wound. When there is limited involve-

ment of one aryepiglottic fold with some extension onto its outer aspect or when there is involvement of the epiglottis and base of the tongue, lateral pharyngotomy, after removal of the thyroid ala and, if necessary, of a portion of the hyoid bone, is preferable, if not absolutely essential. The pharynx is usually opened on the same side as the lesion, but in some instances an opening on the opposite side permits more satisfactory exposure. The lesion may then be removed by sharp or cautery excision, by electrocoagulation or by a combination of these, and, if the extent and activity indicate it, gold radium emanation points or platinum points containing radium element may be implanted as a supplementary measure. In case radium is used, it is advisable that it be sufficiently far removed from the laryngeal cartilages to guard against the possibility of perichondritis.

In cases of extensive growths preliminary tracheotomy greatly lessens the risk of pharyngotomy, but the local reaction following this should be allowed to subside before the latter procedure is undertaken. If a preliminary tracheotomy is not performed, it is advisable to leave a cannula in the trachea on completion of the pharyngotomy, unless the growth is very limited, although it is often surprising to observe the mildness of the reaction in some cases of extensive involvement.

CASE 5.—A man, aged 51, was referred for treatment on Feb. 2, 1933, by the physician at his home who on examination and biopsy had found a moderately active carcinoma of the throat. The patient had had a sore throat and productive cough for seven or eight months previously, following a "cold." For four or five months he had noted difficulty in swallowing and increasing hoarseness, and he had lost weight. Blood had been coughed up several times since the biopsy.

Examination at the clinic gave evidence of an extensive, ulcerated lesion occupying the lower portion of the hypopharynx. Clinically this appeared malignant. It concealed the entire larynx, with the exception of the extreme posterior border of the arytenoid cartilages, and appeared to arise from the epiglottis. Following cocainization and retraction of the growth with a laryngeal applicator, involvement of the base of the tongue could not be seen, but early involvement of the lower portion of the right lateral wall of the hypopharynx and slight limitation of movement of the right arytenoid cartilage were noted. Further investigation of the neoplasm under suspension, after preliminary tracheotomy, was advised.

The trachea was opened on February 4; this was followed by treatments with roentgen rays over the neck. Nineteen days later, laryngeal suspension was applied with the Lynch apparatus. This gave an unsatisfactory view of the lesion as the large, flaccid tongue tended to roll out around the spatula and to fold over its exposed surface. On account of this, only a specimen for biopsy was removed; this revealed squamous cell epithelioma, grade 1. About two weeks subsequently, a subhyoid pharyngotomy was performed after removal of the upper portion of the thyroid cartilage on each side. This gave an excellent exposure of the growth which was seen to involve the entire epiglottis, the adjacent base of the tongue and the right aryepiglottic and pharyngo-epiglottic folds; wide excision was carried out (fig. 7). Because of persistent edema the tracheal cannula was left in place for five and a half months. When last examined in the clinic, six months follow-

ing removal of the growth, the patient was in good general condition, had gained considerable weight and gave no evidence of recurrence of the malignant process. A letter recently received from the local physician stated that the patient was still in excellent general condition and did not give evidence of recurrence of the malignant process.

Other means of laryngoscopy, such as with the direct laryngoscope and the Hasslinger directoscope, may be resorted to for removal of benign and well localized, inactive malignant tumors of the upper part of the larynx. The Hasslinger instrument usually affords a fairly satisfactory view of pathologic changes in this situation, and it permits the operator to use both hands, as an assistant can hold the apparatus in position. It is less satisfactory in most cases of this type, however, than the Lynch method of suspension.

Although radium and roentgen rays are often of considerable value as supplementary measures in the treatment of malignant tumors of the

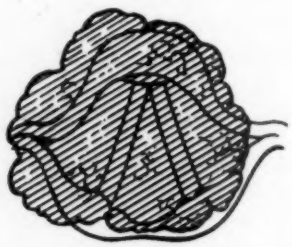

Fig. 7.—Extensive epithelioma of the epiglottis, base of the tongue, right aryepiglottic fold and pyriform fossa, excised through pharyngotomy.

larynx, they should rarely be used to the exclusion of other measures in the treatment of malignant laryngeal lesions that can be removed surgically. Certain types of neoplasm occurring in the supraglottic region, however, respond more satisfactorily to irradiation than to surgical procedure. This is particularly true of some sarcomas, especially of those the limits of which are difficult to ascertain definitely. In such cases treatment with radium or roentgen rays is given externally over the neck, and radium needles are implanted in the tumor by way of the mouth, either direct or indirect laryngoscopy being used. Tracheotomy may be necessary if the growth is extensive, but with this exception surgical measures are not likely to be indicated.

CASE 6.—A man, aged 43, came to the clinic on July 22, 1927, because of hoarseness and dysphagia. Hoarseness had followed a sore throat three or four months previously. Difficulty in swallowing solid foods had been present for only a month and had not been progressive. The patient had lost 20 pounds (9 Kg.). Aside from attacks suggestive of migraine, he had no other complaint.

Examination revealed a large, smooth, nonulcerated tumor in the right side of the hypopharynx which completely obscured a view of the glottis (fig. 8). The

mass measured about 3.5 cm. in diameter, and it apparently sprang from the right glosso-epiglottic fold, although its lower limits could not be definitely determined. There was marked encroachment on the superior aperture of the larynx, but the patient was not conscious of any appreciable shortness of breath. Clinically, the tumor appeared to be malignant.

The general physical examination otherwise gave essentially normal results, and a preliminary tracheotomy was performed. Two weeks after the trachea had been opened the microscopic examination of a specimen removed for biopsy revealed a fibrosarcoma, grade 1. Because of the indeterminate extent of the growth inferiorly, treatment with radium was given externally over the neck and points of radium element were implanted in the tumor. In the course of the next fifteen months three applications of roentgen rays were made over the cervical region. When the patient was seen on Oct. 17, 1928, the tumor had entirely disappeared. As the mass shrank, it was found to be attached to the right aryepiglottic as well as to the right glosso-epiglottic fold. After the tracheal cannula had been corked for several months it was removed on Aug. 15, 1929. When last heard from, three and a half years after beginning treatment, the patient was perfectly well.

Fig. 8.—Fibrosarcoma of the right aryepiglottic and lateral glosso-epiglottic folds.

A method of treatment for carcinoma of the larynx which has been used to some extent in recent years is that devised by Ledoux [4] and championed by Harmer.[5] His procedure consists essentially of intensive treatment with radium, applied in more intimate contact with the growth in the larynx by removal of a varying amount of the thyroid cartilage and, in some instances, of the greater cornu of the hyoid bone as well. The advantages cited for this method, aside from the vastly larger dose of radium that can be delivered to the lesion, are the lessened danger of perichondritis and the much more uniform irradiation of the diseased region that is made possible. When the growth is extensive preliminary treatment with roentgen rays or by surface application of radium is given immediately preceding the insertion of radium. This method of treatment has gained a number of enthusiastic adherents during the short period since its introduction. However, a sufficiently large number of

4. Ledoux and Sluys, A., quoted by Harmer.[5]

5. Harmer, Douglas: Radio-Therapy for Cancer of Nose and Throat, London, John Murray, 1931, p. 15.

cases has not yet been followed nor has a long enough interval elapsed to permit an accurate estimate of the value of the procedure.

Although this method of treatment has not been tried at the clinic, previous experience in treating carcinoma of the larynx with radium does not lead to a great deal of enthusiasm over its possibilities. Whether the procedure will produce sufficiently favorable results to justify its replacing measures the value of which in the treatment of these lesions is already proved remains to be seen. One of the chief objections to its use is the fact that the cartilage which is generally considered the most effective barrier in preventing extension of the carcinoma beyond the larynx is deliberately removed. In case of recurrence of the malignant process, infiltration into the soft tissues of the neck would be likely to take place so promptly that radical surgical intervention could offer little help. Carcinoma of the larynx, recurring even after laryngofissure when the cartilage is intact laterally, is notoriously difficult to control. The major part of the pharyngotomy is completed with removal of the thyroid ala and an opening through the pharyngeal or laryngeal wall, and removal of the growth surgically would add little to the risk of the operation advocated. Implantation of radium to supplement this procedure should give an infinitely better prognosis than treatment with radium alone. In view of the great number of epitheliomas of the cutaneous surface, and of the lips and mouth, that are recurring with increased activity following previous treatment with radium, it appears particularly illogical to use irradiation thus blindly in this more vital and less accessible situation.

SUMMARY

The procedure best suited to the removal of a malignant tumor from the supraglottic portion of the larynx is that affording the most satisfactory view of and the nearest approach to the lesion. Growths limited to the epiglottis can often be taken care of quite as satisfactorily and with less hazard by diathermy and laryngeal suspension as by pharyngotomy. Only inactive, fungating or pedunculated lesions of limited extent should be treated in this manner, however. Pharyngotomy remains the most satisfactory means of dealing with most of the malignant tumors in this situation. Irradiation is a valuable adjunct to the surgical treatment of supraglottic tumors, but it should rarely be used alone in such cases.

The indications for and the technic of the different procedures of value in the treatment of these lesions, together with illustrative cases, are presented.

ADENOMA OF BRONCHIAL MUCOUS GLANDS

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Until comparatively recent times, the lungs were regarded as virtually immune to primary neoplastic diseases. This theory has been disproved in malignant epithelial diseases, i. e., bronchiogenic carcinoma.[1] Benign tumors originating primarily in the bronchopulmonary tree are looked on as rare, but sporadically appearing reports indicate that blastomas are probably not uncommon. These tumors often lead to grave complications which completely obscure the primary cause of the malady in such a way that it is generally overlooked during life. However, many of these benign tumors belong to the category of "accessible" or easily diagnosticated neoplasms and, indeed, can be treated surgically or otherwise with gratifying results.

Benign tumors arising in the lungs are classified as myomas, myxomas, chondromas, enchondromas, rhabdomyomas, lipomas, mixed tumors and adenomas. The case presented here is an example of the last mentioned variety.

REPORT OF A CASE

History.—A man, aged 57, was admitted to the Montefiore Hospital complaining of dyspnea and of cough of several months' duration. Examination revealed signs compatible with emphysema of the lungs and bronchitis. Hypertension and atherosclerosis were noted. He ultimately died with signs of congestive cardiac failure.

Autopsy.—The necropsy corroborated the clinical findings. In addition, there were present an adenoma of the left lower bronchus, an adenoma of the thyroid gland and polypi of the sigmoid.

In the bronchus the adenoma was situated in the left main stem (fig. 1) at the point of its division into the upper and lower branches. The tumor represented a round, smooth, grayish elevation constricted at the base. The cut surface was uniformly pink. The bronchial mucosa in the vicinity of the tumor and the adenoma itself were covered with a thick tenacious mucus.

The tumor was composed of clustered alveolar structures imitating the bronchial mucous glands (fig. 2). The alveoli consisted of large polygonal epithelial cells

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From the Medical Division of the Montefiore Hospital.

Read by invitation at a meeting of the Section of Otolaryngology of the New York Academy of Medicine, May 16, 1934.

1. Fried, B. M.: Primary Carcinoma of the Lung, Baltimore, Williams & Wilkins Company, 1932.

which had a finely granular, acid-stained cytoplasm, with a relatively small, round or ovoid nucleus, pushed to the periphery. Individual alveoli were lined with a layer of flattened cells resembling those of the thyroid or formed diffuse groups without a lumen. The basal membrane was conspicuous throughout the sections; in places there was an abundance of mucus secreted by the cells. No mitoses were present. There was a stroma rich in connective tissue and infiltrated with lymphocytes and numerous thin-walled channels filled with blood.

Fig. 1.—Polypoid adenoma protruding into the bronchial lumen (arrow).

The tumor was walled off at its root by the cartilaginous plates of the bronchus. The new growth protruding into the bronchial lumen was lined with a layer of basal cells, differentiating in places into stratified squamous epithelium (fig. 3). In many areas, the surface of the adenoma formed papillary projections into the bronchial lumen, resembling chorionic villi. Beyond the tumor, the mucosa of the bronchus was desquamated for some distance, and the bronchial submucosa showed an increase in loose connective tissue infiltrated with lymphocytes. In the area where the adenoma made its escape into the bronchial lumen, there had occurred a destruction of the smooth muscle fibers encircling the bronchus and also of the elastic armature. There were chronic bronchitis and emphysema.

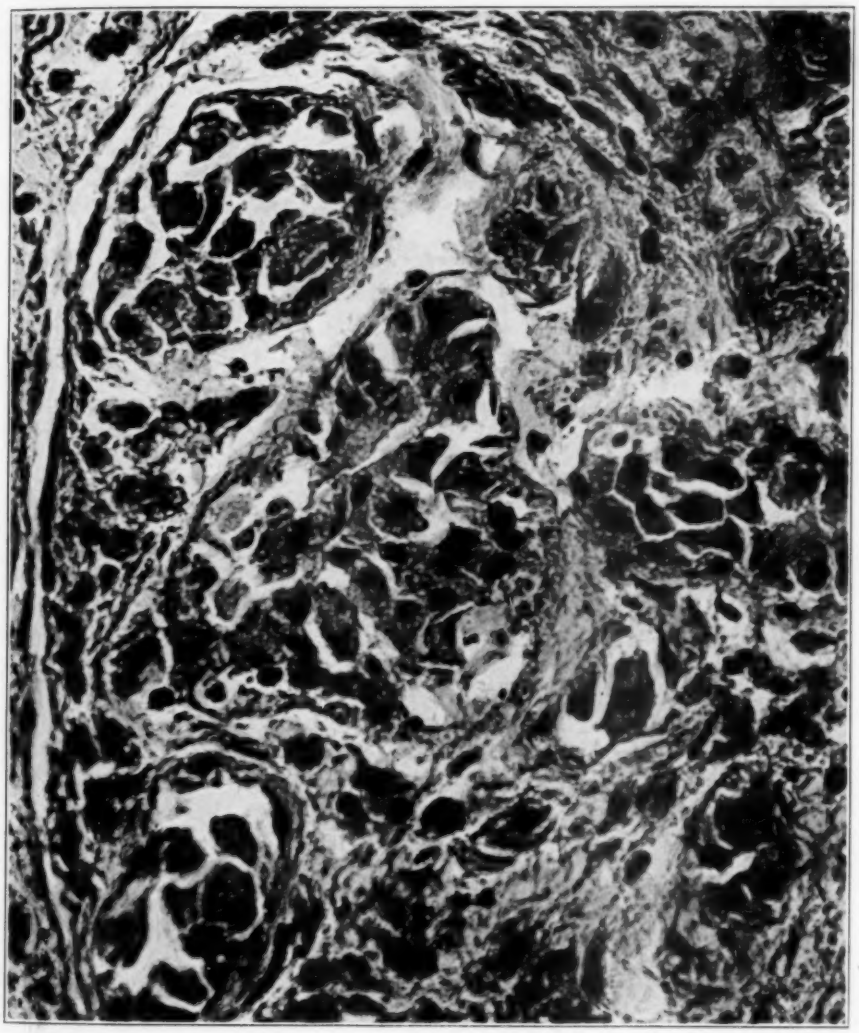

Fig. 2.—Structure of the tumor (high magnification).

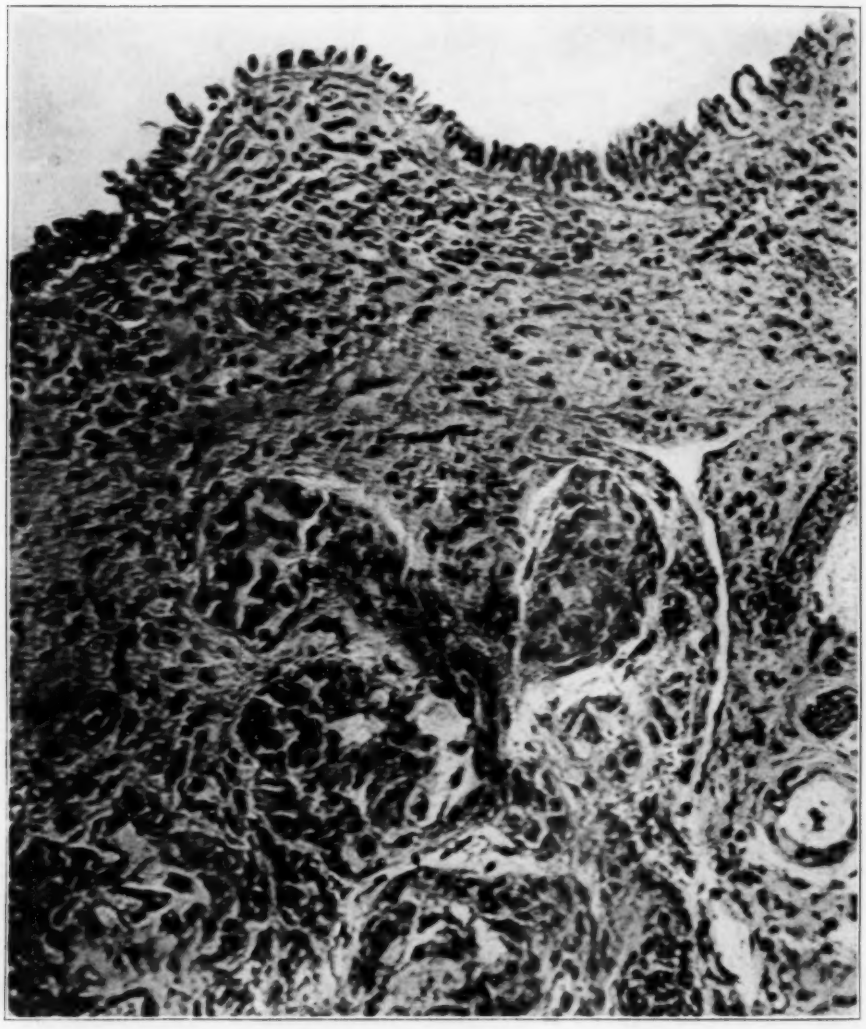

Fig. 3.—Microscopic structure of the adenoma which is lined with basal cells (low magnification).

COMMENT

Pathologic Anatomy.—Adenomas are slowly growing, well circumscribed tumors having an alveolar structure and the function of the mother gland. The presence of the tumor can produce mechanical (pressure or obstruction) as well as chemical effects. For example, adenomas of the thyroid and parathyroid glands, those of the islands of Langerhans and some adenomas of the hypophysis are harmful solely by virtue of their chemical activity.

Unlike the adenoma malignum, the benign form does not metastasize to distant organs. When a benign adenoma seemingly metastasizes, it is important to ascertain the true nature of the primary growth which, in all likelihood, is malignant rather than benign.

As the etiology of these benign neoplasms is not understood, it is thought that they may be initiated by a preexisting chronic inflammation, or they may represent a congenital anomaly. This is true particularly of cases of multiple adenomatosis.

Unlike a carcinoma which arises in the cells lining the bronchial mucosa, adenomas originate in the mucous glands. They are therefore encountered in the walls of the larger bronchi and not in those whose diameter is 10 mm. or less and which are deprived of mucous glands. As they grow very slowly, they exhibit a tendency to advance toward the lumen of the bronchus—the *locus minoris resistentiae*—and there the endobronchial new growth, during its early stages, forms a mamillary or a polypoid elevation, constricted at the base and covered with the changed bronchial mucosa which it has stretched and pushed forward. Later on the growth assumes a pyriform or a ball-like contour projecting upward toward the trachea, the expulsive effort of coughing forcing the growth outward.[2]

The polypoid adenomas of the bronchi are usually covered with basal cells which normally lie close to the basal membrane at the base of the ciliated columnar cells of the bronchus. In places, these basal cells form a layer of stratified squamous epithelium (metaplasia or protoplasia) which is looked on as a precancerous condition. It is noteworthy that Reisner,[3] in a report of a case of polypoid adenoma of the bronchus, asserted that the tumor showed evidence of a malignant degeneration. His photomicrograph, however, is not altogether convincing on this point.

Clinical Features.—The symptomatology of the tumor can be divided into two stages: the preobstructive and the obstructive stage. In the first stage, the adenoma acts primarily like any foreign body in the

2. Kramer, R.: Ann. Otol., Rhin. & Laryng. **39**:689, 1930.

3. Reisner, D.: Intrabronchial Polypoid Adenoma: Report of a Case, Arch. Surg. **16**:1201 (June) 1928.

bronchus, causing a "bronchial" cough resisting medication. The expectoration is usually mucoid and, as a rule, is not blood-streaked. Most observers describe a peculiar wheeze in the chest heard at the open mouth.[4] There is soreness in the affected side of the thorax, and what is looked on as pathognomonic is the occurrence of abrupt and often copious hemorrhages, which are ordinarily interpreted as caused by a tuberculous infection. In women they have been observed to coincide with the menstrual periods.[5] In these cases the pathogenesis of the bleeding is probably the same as that observed in metaplasia (leukoplakia) of the urinary tract, due possibly to the rupture of the newly formed, thin-walled blood channels which abound in the polypoid growth as well as in the adjacent damaged bronchial wall. Whenever hemoptysis persistently occurs with no evidence of changes in the lungs or in the portal circulation (cirrhosis of the liver, chronic splenomegaly),[6] it is imperative to investigate the bronchi.

With the advance of the growth, in addition to the symptoms just enumerated, the complaints are those of bronchial obstruction and of superadded pulmonary inflammation in which the entire segment of the lung distal to the adenoma is involved. Thus, in the pulmonary parenchyma there occurs a pneumonitis with wide areas of atelectasis; in the bronchi there are bronchitis, abscesses and bronchiectasis. Occasionally, empyema and pleurisy develop. In the case reported by Reisner,[3] a woman aged 47 had suffered for several years from symptoms of a respiratory disease associated with cough and expectoration. She had undergone several operations for empyema, and she died following an operation on a cavity at the base of the lung. In retrospect, the fact was apparent that her protracted illness was caused by an unrecognized obstructing tumor of the type described here. Similar cases have been reported by others.

From the foregoing data it is apparent that the tumor of itself may be "innocent" but its potentiality for producing complications is grave. Accordingly, it is important to recognize the presence of the new growth as early as possible. It may occur at any age. Its presence can probably be detected in most instances by the bronchoscope. A competent bronchoscopist can, as a rule, readily differentiate between a malignant bronchiogenic carcinoma with its attendant rigidity, narrowing and roughening of the bronchus and a benign bronchiogenic adenoma which is characterized by its polypoid projection into the lumen of the bronchus.

4. Jackson, C., and Jackson, C. L.: Benign Tumors of the Trachea and Bronchi, J. A. M. A. **99**:1747 (Nov. 19) 1932.

5. Turner, P. A.: Kentucky M. J. **31**:423, 1933.

6. Fried, B. M.: New England J. Med. **207**:595 (Oct. 6) 1932.

Moreover, careful microscopic observation of the removed tissue will indicate the nature of the growth.

The biopsy material should be studied with the utmost care, for it is known that isolated sections may show features which resemble malignant disease.

SUMMARY

A case of adenoma of the bronchus is reported with detailed clinical and pathologic features.

The tumor is benign, originating from the cells of the bronchial mucous glands. Its early removal is followed by cure; failure to remove it leads to grave and even fatal bronchopulmonary changes.

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RECURRENT BASAL CELL CARCINOMA OF THE NASAL SEPTUM

HISTOGENESIS OF SO-CALLED CYLINDROMAS

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Nomenclature has often led to confusion in the literature because the terminology has not been carefully followed and synonyms have been carelessly applied. The following case is an example of a rare tumor of the nasal mucosa the structure of which is characteristic. In the few similar cases reported, however, classification has been confused by the lack of uniformity in terminology. Thus the same type of tumor arising from the oral and respiratory mucous membrane has been reported in the foreign literature as cylindroma, basal cell carcinoma and endothelioma. A comparable tumor has not been described in the American literature, although a case practically identical in its clinical course and histologic picture was studied by Jaffé.[1] Beck and Guttman [2] included 2 so-called cylindromas in their survey of 579 tumors of the nose and nasal sinuses without describing the histologic details of the individual cases.

REPORT OF CASE

History.—A white man, aged 54, complained of interference with breathing and repeated spontaneous nasal hemorrhages from the left naris for six months. A diagnosis of tumor (not classified) was made by another physician, and removal was undertaken by cautery. Three months later the patient came to me, the original symptoms having persisted. Examination revealed a dark red mass of tissue completely filling the left side of the nose and presenting at the nostril. The mass obscured all of the structures of the nose, but a probe could be passed around it in all directions, except where it was attached about 6 cm. posterior to the nostril on the superior septal side. Examination of the nasopharynx showed the tumor to extend to the left posterior choana. The tumor bled profusely on the slightest touch. The results of the examination were otherwise negative and operation was advised. The tumor was completely removed by snare and punch, the operation being complicated throughout by active hemorrhage which continued so profusely that it was necessary to keep a pack in the nose for twenty-four hours. After removal of the tumor, the turbinate bones were seen to be compressed against the lateral wall. The site of attachment of the tumor was in the

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From the Department of Laryngology, Rhinology and Otology, University of Illinois College of Medicine.

1. Jaffé, R. H.: Personal communication to the author.

2. Beck, J. C., and Guttman, M. R.: Malignant Diseases of the Nose and Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **41**:1, 1932.

upper septal region and measured about 2 by 3 cm. The patient was entirely free from symptoms during the subsequent seven months of observation. However, he returned eleven months after operation (twenty months after the onset of the original symptoms) again complaining of nasal obstruction and repeated hemorrhages from the left naris. Examination showed a recurrence of the tumor, about 4 cm. in length, at the original point of attachment. Removal was attempted, and severe hemorrhage resulted. The patient's condition due to loss of blood did not permit complete removal at this time. He returned after two months, and the remainder of the tumor was excised. He obtained complete relief, only to have a recurrence six months later in the form of an ovoid mass 2 cm. in size. Excision followed by treatment with radium was advised, but permission for irradiation was refused. The patient went untreated for six months, when surgical removal of the recurrent tumor mass was performed, but permission for irradiation was again refused. At no time was there evidence of invasion of the surrounding nasal structures. Thorough general examination, including examination of the head and neck, failed to reveal any evidence of metastases. A roentgenogram of the sinuses showed no pathologic process. In August 1933, four years after the onset of the original condition, the patient showed evidence of recurrence.

Microscopic Study (Dr. G. Milles).—The section was grossly ovoid. Here and there a small islet of ciliated columnar epithelium had been preserved on the surface, with an interlocking basal layer of polyhedral epithelial cells. At a few points where the columnar cells had been lost, the basal cells were still present. Immediately beneath the epithelium, or constituting the free border where the epithelium was missing, was a uniformly dense band of connective tissue 5 mm. in width (fig. 1 *A*). This zone stood out prominently, separating the surface epithelium from the inner zone.

The bulk of the tumor (fig. 1 *B*) consisted of epithelial nests in connective tissue stroma. The nests were variable in size and from ovoid to irregular in outline, and they often presented as anastomosing cords (fig. 1 *C*). In many of them a more or less intact marginal layer of polyhedral to columnar cells was seen (fig. 2 *A*). The cells had a moderate amount of pink-staining homogeneous cytoplasm and rounded, ovoid or polyhedral nuclei containing finely granular and uniformly distributed deep purple staining chromatin which was somewhat more dense about the nuclear border. Cells which were polyhedral but otherwise conformed to the foregoing description were present as a compact mass accompanied by a variable amount of pink-staining granular and reticular débris, occupying the remainder of the nest in most instances (fig. 2 *B*). A few of these central cell groups were separated from the margin by a variable-sized space, some of which contained débris (fig. 2 *C*). In a few of the epithelial structures only a small number of cells were seen in large spaces. Here and there a hyaline ring was seen in the center of one of these structures, but in other instances the structures were recognizable as hyalinized blood vessels attached to the margin by a papillary fold.

The stroma was made up of mature, moderately vascular connective tissue. Here and there the stroma was loose and edematous, and in areas, especially about some of the epithelial nests, it was hyalinized. A single mucous gland was found in one section (fig. 1 *D*).

With van Gieson's stain, the cellular elements occupying the spaces and the granular débris stained yellow, and little pink-stained connective tissue was present in the stroma.

In general, the tumor was composed of anastomosing cords and nets lined with epithelial cells which appeared to have proliferated and desquamated into a central

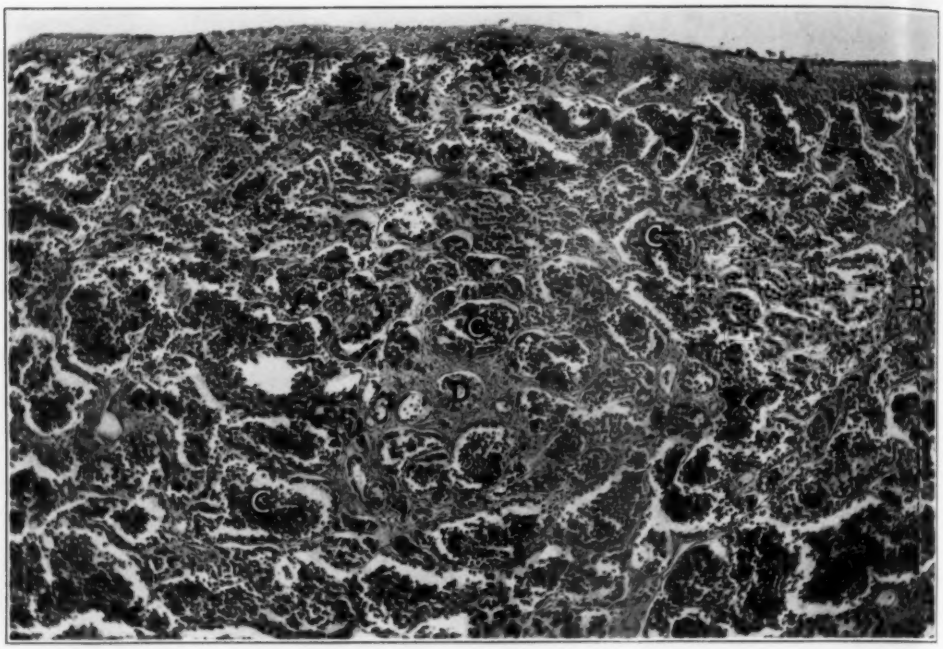

Fig. 1.—Low power magnification of a section of the tumor: *A*, connective tissue limiting margin; *B*, bulk of the tumor made up of cell nests; *C*, individual nests of epithelial cell; *D*, mucous glands.

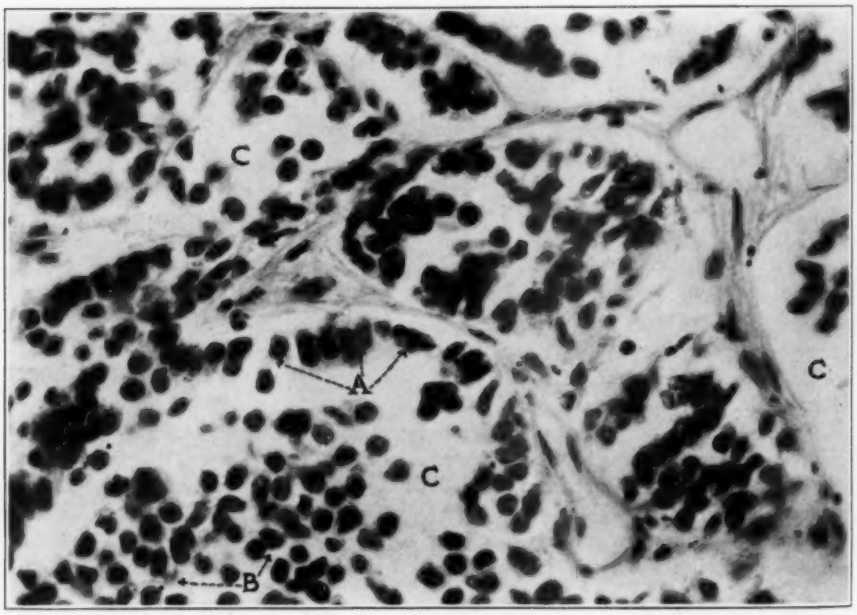

Fig. 2.—High power magnification of a section of the tumor: *A*, marginal columnar cells; *B*, central polyhedral cells; *C*, central spaces. Hematoxylin and eosin.

lumen, or the central lumen contained only variable amounts of granular and fibrillar débris and a few cells. These nests were separated from the surface of the tumor by a uniform, narrow band of connective tissue.

Summary.—A white man, aged 54, had a massive vascular tumor obstructing the left naris which recurred repeatedly after removal, but after four years had failed to invade the surrounding structures or give rise to metastases. Histologically, it was characterized by nests of only slightly anaplastic epithelial cells resembling closely the basal cells of the surface epithelium.

REVIEW OF LITERATURE

In 1856, Billroth [3] described a tumor of the orbit which was characterized by nests of what he considered to be epithelial cells. Each nest was surrounded by a sharply defined hyaline ring which appeared to be separate from the stroma and from the tumor cells. In some instances a central space contained a similar hyaline core. He considered this hyaline material to be derived from the connective tissue, probably as a result of degenerative changes, and he coined the term "cylindroma" for this particular type of tumor. In the case he described the tumor recurred seven times after removal without the formation of distinct metastases. Since this original description, a wide variety of tumors, some identical with, and others differing considerably from, the original description of Billroth, have been reported in the literature under the name of cylindroma. Similarly, the various conceptions of the histogenesis of this tumor are by no means settled. Ewing,[4] for example, described a cylindroma as a tumor the stroma of which appears to form elongated twisted cords of hyaline material. He considered this tumor to be a basal cell carcinoma. Denker and Kahler [5] considered the histogenesis of this tumor still to be an unsettled problem. These authors were of the opinion, however, that there is much in favor of the epithelial origin of the tumors, a conception championed by Ribbert. In the same text, however, in the chapter written by Frühwald, cylindromas are considered of endothelial origin. Kaufmann [6] discussed rather briefly the various conceptions of the histogenesis of cylindromas. He concluded that they must be looked on as epithelial tumors, and classified them as cylindromatous epithelial carcinomas.

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3. Billroth: Untersuchungen ueber die Entwicklung der Bludgefaesse, Berlin, G. Reimer, 1856. Beobachtungen ueber Geschwuelste der Speicheldrusen, Virchows Arch. f. path. Anat. **17**:359, 1859.

4. Ewing, J.: Neoplastic Diseases, Philadelphia, W. B. Saunders Company, 1928, pp. 55 and 769.

5. Denker, A., and Kahler, O.: Handbuch der Hals-Nasen-Ohren-Heilkunde, Berlin, Julius Springer, 1929 pp. 101 and 224.

6. Kaufmann, E.: Pathology for Students and Practitioners, translated by S. P. Reimann, Philadelphia, P. Blakiston's Son & Co., 1929.

There is but scanty material in the literature on this subject. Barbezet [7] reviewed it exhaustively, and described a case in which the right half of the face and the orbit were involved. The patient, a man, aged 30, died of metastases into the brain. Microscopically, the tumor was made up of isolated and confluent nests of polyhedral epithelial cells having moderate-sized, well stained ovoid to round nuclei and moderately abundant cytoplasm. Some of the cell nests had central spaces containing pink-staining homogeneous material. The author concluded that the tumors were epithelial, very likely originating in the mucous membranes of the nasal or the accessory sinuses. Barbezet did not believe in the possibility of these tumors originating from the lacrimal gland.

Eigler [8] reviewed the rare tumors of the upper air passages, including endotheliomas, peritheliomas and cylindromas. He reported 4 cases of cylindromas, which presented a similar histologic picture in that they were made up of epithelial cords in a plexiform arrangement. The individual cords were of variable size and occasionally contained rounded spaces filled with homogeneous material. The epithelial cells making up these cords were polyhedral with moderate-sized, deeply stained nuclei and well stained cytoplasm. The stroma was variable in amount and was made up of connective tissue fibers with but little hyaline change. The distribution of these tumors was as follows: in 2 cases on the palate, in 1 in the larynx and in 1 at the base of the tongue.

Ferreri [9] reported 3 cases of cylindromas and concluded that they were of endothelial origin without giving proof for this conception. Microscopic examination showed no hyaline cylinders, but there were spaces surrounded by what he considered to be endothelial cells. Some of the spaces were cystic and contained hyaline material; others were filled with cellular débris.

Pfeiffer [10] reported 2 cases under the title "cylindroma." Like the case reported here, the histologic picture was characterized by anastomosing and circumscribed cords of cells. Admitting the difficulty of proving any particular origin, he considered these tumors to be derived from the endothelium.

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7. Barbezet, Charles: Ueber Cylindrome, Virchows Arch. f. path. Anat. **223**: 242, 1917.

8. Eigler, G.: Ueber Endotheliome, Peritheliome, Cylindrome und ähnliche Tumoren der oberen Luftwege, Arch. f. Ohren-, Nasen- u. Kelhkopfh. **132**:209, 1932.

9. Ferreri, G.: Contribution à l'étude clinique et anatomopathologique du cylindrome du maxillaire superior, Acta oto-laryng. **12**:411, 1928.

10. Pfeiffer, W.: Ueber die Cylindrome der oberen Luftwege, Arch. Laryng. **27**:516, 1913.

Davies [11] reported a case of a tumor of the scalp composed of epithelial cords without surrounding hyaline sheaths. He concluded that in spite of the absence of the typical picture described by Billroth this growth should be classified as a cylindroma, and he added further that the entire group of so-called cylindromas are merely basal cell carcinomas.

Stillians [12] reported a classic case of cylindroma. It occurred as multiple tumor masses on the scalp and on the face. The author concluded that cylindromas of the scalp are basal cell epitheliomas originating from the surface epithelium or from the hair follicle and suggested that the name "nevo-epithelioma adenoides," given to this group by E. Hoffman, is the most appropriate.

The extreme lack of uniformity as to what should be classified under the term "cylindroma" is indicated by Friedreich,[13] who described as a cylindroma a rapidly growing tumor of the upper jaw which he considered to be derived from the connective tissue of the gum or periosteum. This patient died three years later of medullary carcinoma without local recurrence.

Volkmann [14] and Citelli [15] insisted that these tumors are of endothelial origin derived from the blood or lymph vessels, while Kolaczek [16] wanted to drop the term "cylindroma" entirely and call the tumors angiosarcomas.

The subject has been clarified, however, by Krompecher [17] in his monograph on basal cell carcinomas of the skin and mucous membranes and the mixed tumors of the parotid glands. He placed cylindromas as a definite subgroup in the larger more sharply defined class of basal cell carcinomas. He definitely subdivided the group of basal cell carcinomas into the solid adenoid and cystic types and considered their possible origin from the skin, mucous membranes or cutaneous glands. He described 4 cases occurring in the nose and pointed out that these

11. Davies, J. H. T.: A Contribution to the Histology of the Cylindromatous Tumors of the Scalp, Brit. J. Dermat. **40**:241, 1928.

12. Stillians, A. W.: Nevo-Epithelioma Adenoides (Cylindroma) of the Scalp, Arch. Dermat. & Syph. **27**:481 (March) 1933.

13. Friedreich, Z.: Zur Kasuistik der Neubildungen, Deutsche Ztschr. f. Chir. **27**:357, 1863.

14. Volkmann, R.: Ueber endotheliale Geschwuelste, Deutsche Ztschr. f. Chir. **41**:1, 1895.

15. Citelli, S.: Cylindrom des Sinus sphenoidalis, Arch. f. Laryng. u. Rhin. **15**:252, 1904.

16. Kolaczek, J.: Ueber das Angiosarkom, Deutsche Ztschr. f. Chir. **9**:1, 1878.

17. Krompecher, E.: Der Basalzellen Krebs, Arch. f. Laryng. u. Rhin. **31**: 443, 1918; Basalzellen Tumoren der Zylinderepithelschleimhäute, Beitr. z. path. Anat. u. z. allg. Path. **65**:79, 1919; Zur Histogenese und Morphologie der Mischgeschwuelste der Haut sowie der Speichel und Speicheldruesen, ibid. **44**:51, 1908.

tumors in either the skin or the mucous membranes are much alike microscopically. Indeed, the similarity may be so great as to preclude definite identification as to the origin of the growth. He considered basal cell carcinomas of the mucous membranes to be derived from the basal cells of columnar epithelium and emphasized the fact that in contrast to the basal cell carcinomas of the skin, which are usually of the solid type, the adenoid and cystic types predominate in the mucous membranes. He stated that the cylindromas of the nares are always derived from polyps. He concluded that this group of nasal tumors is relatively benign but may rarely become quite malignant.

In support of Krompecher's classification, Ewing divided the basilomas into reticulated basal cell carcinomas corresponding to Krompecher's solid type, which group includes the typical rodent ulcer and the adenoid type, showing a more or less pronounced tendency to reproduce glandular structures. Ewing described basal cell carcinomas of the nose as being composed of anastomosing cords of cells having little cytoplasm and prominent deeply stained nuclei. The stroma is usually scanty in amount and tends to undergo hyaline changes.

Kaufmann recognized the varied histologic picture possible in basal cell carcinomas and considered that the spaces that are frequently seen within the cords arise either from destruction of carcinoma plugs or from the previous presence of hyaline or mucoid stroma in this part of the cord. He emphasized the cylindric appearance of the marginal cells of the cords as contrasted with the rounded to polyhedral form which they take in the center.

In contrast to the preceding authors, Michel,[18] after reviewing the literature on tumors of the antrum, attempted to show that the tumors variously described as cylindromas, endotheliomas, carcinomas and sarcomas are frequently derived from mixed tumors of the parotid type. He concluded that tumors of the antrum and ethmoid usually called cylindromas have their origin in a persistent lateral nasal gland called Steno's gland. This structure is always present in lower animals, such as the dog, but is usually absent in primates.

Billroth's conception of the histogenesis of cylindromas has been resurrected by Samuels[19] in his discussion on tumors of the orbit, in which he pointed to their morphologic similarity to basal cell carcinomas.

CONCLUSIONS

It is apparent from this review of the representative literature that the growth in my case is an example of a group of rare tumors of the mucous membranes of the upper respiratory passages which present a

18. Michel, K. H.: Zur Kenntnis der Nasenhöhlengeschwülste, Frankfurt. Ztschr. f. Path. **43**:354, 1932.

19. Samuels, B.: Tumors of Orbit, Tr. Am. Acad. Ophth., 1931, p. 41.

fairly typical clinical picture but about which there is little agreement among authors with regard to histogenesis and classification.

Clinically, this group of tumors is relatively mildly malignant, recurs locally after removal and invades the surrounding structures late if at all.

The cells making up the characteristic nests are epithelial from the standpoint of their arrangement and morphology. They resemble closely the basal cells of the covering layer of epithelium, and Krompecher traced them to this layer. Because of this morphologic similarity, as well as their clinical resemblance, they would best be classified as basal cell carcinomas.

The tendency of some workers to consider a tumor of endothelial origin if its cells remotely resemble that pleomorphic type of tissue is nowhere better illustrated than in the few reports cited here.

The term cylindroma is quite inappropriate for this type of tumor. However, it is descriptive of a particular morphologic feature encountered in what is now recognized to be a rather characteristic subvariety of basal cell carcinoma. This characteristic feature, namely, hyaline cylinders surrounding the individual cell nests or central, well defined, hyaline cores within the cell nests, is absent in my case as well as in many cases of so-called cylindromas reported in the literature. Therefore, reserving the name cylindroma for the characteristic tumor described by Billroth, the remainder should be classed as basal cell carcinomas of the mucous membrane and skin, and the terms employed by Krompecher to describe the varieties—solid, cystic and adenoid—should be used for their finer classification.

SUMMARY

A rare tumor of the naris was studied and compared in its clinical and anatomic features with similar tumors, variously described in the literature as cylindromas, endotheliomas, etc.

In my opinion, these tumors are basal cell carcinomas and should be so classified, with the addition of such descriptive terms as solid, cystic or adenoid, as suggested by Krompecher.

Following this recommendation, the case reported here should be classified as one of a solid and cystic cell carcinoma of the mucous membrane.

A MODIFICATION OF AUDITORY THEORY

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Our experiments on the auditory mechanism have recently been directed toward two main objectives: (1) to examine the action potentials of the auditory nerve in relation to the frequency, intensity and duration of the stimulating sound, and (2) to determine the relation of the electrical response of the cochlea to the initiation of these nerve impulses. Establishment of these relationships should go far toward elucidating the physiology of the organs of hearing and clarifying the auditory theory.

It has already been established [1] that the cochlear response differs fundamentally from the action potentials of nerve and muscle: 1. It shows no characteristic wave form of its own, but reproduces that of the stimulus. 2. It is not followed by a refractory period. 3. It is immune to fatigue, anesthesia and cold. 4. It may begin by either a positive or a negative electrical change depending on whether the initial stimulating (sound) pressure is positive or negative. We have also confirmed the observation of Howe and Guild [2] that this response is absent in albinic cats which on histologic examination are found to lack the organ of Corti. We have ventured the hypothesis that the sensory cells of this organ are responsible for the electrical change and that the organ of Corti may be the agent which directly stimulates the auditory nerve fibers.

As yet we have been unable to establish this hypothesis except indirectly by a study of the relations between the cochlear response and

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1. Davis, H.; Derbyshire, A. J.; Lurie, M. H., and Saul, L. J.: Am. J. Physiol. **107**:311, 1934. Saul, L. J., and Davis, H.: Action Currents in the Central Nervous System: I. Action Currents of the Auditory Tract, Arch. Neurol. & Psychiat. **28**:1104 (Nov.) 1932.

2. Howe, H. A., and Guild, S. R.: Anat. Rec. **55**:20, 1933.

the action potentials in the auditory nerve. Four months ago we believed that we had made a fairly complete preliminary survey of the electrical phenomena, and we were bold enough to contemplate a rather sweeping modification of the auditory theory. Subsequent experimental observations, however, have revealed additional complications, so that our report today is richer in fact and poorer in fancy.

The most important of these new observations is that an electrode placed in contact with the round window or the promontory detects action potential of the nerve as well as the true cochlear response. In the lower portion of the frequency range this component may amount to 30 per cent of the total response. The cathode ray oscillograph shows that the latency of this component with respect to the stimulating sound wave is from six to nine ten-thousandths second as compared with less than one ten-thousandth second from the cochlear response. It is far more susceptible to masking by adventitious noises than the latter and also differs from it by all the aforementioned criteria.

This action potential or nerve component had long been noted in our oscillograms, but had been interpreted erroneously as due to harmonics introduced by the ossicles and tympanum. It now appears that the mechanical distortion of wave form is slight except at high intensities or at very low frequencies. This greater simplicity of the true cochlear response facilitates a quantitative interpretation of the mechanics of the ear, although in order to obtain perfect records of the cochlear response it may be necessary to sever the auditory nerve in our experimental animals and allow it to degenerate. Approximate elimination of the nervous component at moderate intensities of stimulation may be obtained by masking with a noise. A rough noise of rather high pitch, such as scraping one's feet on the floor, rubbing sandpaper or the voice sound sh-h-h, is particularly effective. Such sounds leave the cochlear response to a pure tone or to impulsive "clicks" unaffected, merely adding to it, but they greatly reduce and may almost completely eliminate the nerve component. The suppression of the nerve impulses as measured directly in the auditory nerve is equally complete.

We have not yet had an opportunity to study systematically the masking of one pure tone by another by this technic, but the mere fact of a differential effect of the sort described is of great theoretical interest. Apparently masking is not due to purely physical interference by the masking disturbance with the motion of the basilar membrane caused by the pure tone. Both are simultaneously represented in the cochlear response, which, we may recall, seems to originate in the organ of Corti. It seems that the interference takes place in the nerve fibers themselves. This is not only possible but should be anticipated if a single nerve fiber makes connections with many sensory cells. Accord-

ing to Lorente de Nó,[3] the external hair cells are innervated in just this fashion. The physiologic principle involved is that an impulse set up in one of these nerve fibers by activity in any one of its sensory cells renders it refractory so that it cannot respond to any other sensory cell for a time interval of at least one-thousandth second. Further speculation in advance of exact experimental data is useless, but this phenomenon should make possible a far-reaching analysis of masking itself, of the innervation of the basilar membrane and of the nature of the response to noises as opposed to pure tones.

The threshold of stimulation, that is, the least strength of stimulus at which we obtain a visible response on the oscillograph, shows for both cochlear and neural response a remarkable similarity to the human audibility curve as determined with the same apparatus. Every improvement in our technic has resulted in a closer and closer correspondence, both qualitatively and quantitatively. This seems to be good evidence of the high sensitivity of our experimental methods and also to justify the use of the cat as an experimental animal on which to study the mechanism of hearing.

A word of caution is in order. If the electrical response which is being used as an index of the efficiency of the auditory mechanism is a composite of cochlear and neural response, as is the case when an unshielded electrode is placed in the auditory nerve or on the round window, strange anomalies may appear at certain frequencies. The two components are not simultaneous and do not have the same wave form. At certain frequencies they reenforce one another and at others they interfere. In the latter case reduction of one of them while the other remains unchanged, as in masking of the neural component, may actually increase the apparent total response.

At present such points as these are of practical significance only for those who are using these electrical phenomena as tools in research, but we believe that it is worth calling attention to them as against the time when we shall be considering the possible value and practicability of diagnostic tests based on these phenomena.

Certain definite conclusions have emerged from the study of the action potentials in the auditory nerve itself. By the use of suitably shielded (coaxial) electrodes we can record nervous responses alone without any component due to the cochlea itself. The voltage of the action potential wave can be related to the strength of the stimulating sound and also to the amplitude of the electrical cochlear response. The comparison is possible only at frequencies below the limit imposed by the refractory period of the nerve fibers, say 1,000 per second. The significance of this limitation will be considered later. On the

3. Lorente de Nó, R.: Laryngoscope **43**:1, 1933.

other hand, the comparison cannot be made at too low a frequency, owing to the fact that prominent harmonics appear with strong stimuli, but in spite of the limited range of observation it is of great significance that the two types of response, cochlear and neural, run almost exactly parallel to one another. They both increase very rapidly at first and then rise more slowly to a maximum. If the stimulus is measured in logarithmic units, as in the decibel or sensation unit scale, the curve is sigmoid, rising very slowly at first, then rapidly, then more slowly again to a maximum. The relationship is similar to that described by the psychologists Weber and Fechner for the general relation of the intensity of a subjective sensation to the stimulus. In the case of the cochlear response the same type of relation holds up to the highest frequencies we have measured, above 4,000 per second. The close relationship of the two types of response to one another is strong supportive evidence for the hypothesis that the cochlear response is intimately associated with the process of initiation of the nerve impulses. The significance of the correspondence of the neural curve to the psychologic relationship described by Weber and Fechner will be considered shortly. First, however, we must return to the question of the maximal frequency of impulses in the individual nerve fibers.

We have stated this maximal frequency as 1,000 per second, which is what can be expected if the properties of the neurons of the eighth nerve are the same as those of the same diameter elsewhere in the body. We have direct experimental evidence in support of this figure, which turns on the changes in the size of the action potential waves during continued maximal stimulation at various frequencies. At frequencies up to 600 or 800 per second the initial size of the waves (measured immediately after the "on-effect") is well maintained, showing only the rather slight fatigue familiar in other nerves. At slightly higher frequencies the diminution is much greater, amounting to as much as 60 per cent in two seconds. At still higher frequencies, say 1,200 per second, the initial response (again disregarding the "on-effect" which is independent of frequency) is only about half as great as at lower frequencies, but the subsequent fall is much less. The interpretation is simple, since it is well known that the refractory period of a nerve fiber becomes prolonged during very rapid activity of this sort, and that as a consequence the nerve then responds only to alternate stimuli. The rapid fall in the size of the total action current is due to the individual fibers responding at first to every sound wave and then, as they become fatigued, to every other sound wave. The phenomenon is closely analogous to partial heart block, in which the ventricle responds only to alternate auricular contractions whenever the cardiac rate rises above a critical rate. The physiologic principles involved are identical. The range of frequency in which this effect

occurs indicates the maximum frequency which it is possible for the individual fiber to carry. If the interpretation is correct, there should be another range of frequency an octave higher in which the rapid diminution in size should appear again as the fibers pass from responding to alternate sound waves to a 1:3 pattern of response. This second range appears clearly in the experimental data, and in favorable preparations even a third such range at triple the critical frequency can be demonstrated. Above this the impulses in the nerve are so disordered and asynchronous that no such measurements are possible. The stimulating tone is no longer reproduced from the loud-speaker, but instead there is merely a disorganized rush and roar.

It is interesting to compare this behavior of the nerve impulses in the auditory nerve with our subjective sensation on listening to tones of these same frequencies. Although the experiments have been carried out on cats, we have an increasing body of evidence showing the close quantitative similarity between the human and the feline ear, and the comparison is probably legitimate. Fatigue of the human auditory sense is relatively slight and transient, but has been successfully measured by Békésy [4] and others. Békésy reports that it is approximately equal in degree and rapidity of development for all frequencies between 300 and 2,000, with no intimation of the marked variation with change of frequency in the neighborhood of 1,000 per second which we have just described for the activity of the auditory nerve. The great diminutions which we observed at this frequency during the first one or two seconds of stimulation depend primarily on a reduction in the total number of impulses per sound wave passing up the nerve and cannot be identified with fatigue as measured by Békésy. We do find, as a matter of fact, a second much smaller change, relatively independent of frequency, which may well correspond to subjective fatigue. We wish to emphasize the point that there seems to be no subjective counterpart for the great reduction during the first one or two seconds of stimulation in the total number of impulses per second passing up the auditory nerve under the particular conditions which we are discussing. We must conclude that the subjective sensation of loudness does not depend simply on the total number of impulses passing up the auditory nerve per unit of time. This conclusion is diametrically opposed to the assumptions of Fletcher,[5] Troland [6] and others and to the general inferences from the work of Adrian [7] and his collaborators on other sensory systems. It is, however, strongly supported by the

4. Békésy, G. V.: Physik. Ztschr. **30**:115, 1929.

5. Fletcher, Harvey: J. Acoust. Soc., America **1**:311, 1930.

6. Troland, L. T.: J. Gen. Psychol. **2**:28, 1929.

7. Adrian, E. D.: The Mechanism of Nervous Action: Electrical Study of the Neurone, Philadelphia, University of Pennsylvania Press, 1932.

Weber-Fechner relationship heretofore described between the amplitude of the action potentials in the nerve and the intensity of the stimulating sound. Since, at frequencies below 600 per second, the frequency of impulses in each fiber is strictly determined by that of the stimulating sound waves, the amplitude of the response can vary only because of a variation in the number of active fibers. The all-or-none law of nerve response precludes a possible grading of the size of impulses with changes of intensity of stimulation. We find therefore that the number of active fibers is the correlate of intensity of stimulation and of loudness in sensation.

We may further conclude that at frequencies as low as 500 per second the sensation of pitch does not depend on the frequency of impulses in the individual fibers. When the ear is stimulated by a strong tone with a frequency of 1,000, the individual fibers rapidly pass from a 1:1 to a 1:2 pattern of response, the frequency in each falling to 500 per second. No subjective change is observable in the pitch of such a tone.

While the presence of the stimulating frequency in the response of the nerve is undoubtedly significant in binaural phenomena such as localization of the source of sound, it nevertheless appears more and more definitely to be merely an incidental relationship resulting from the intermittent nature of the stimulus and of nerve impulses. We are unable as yet to assign to it any more fundamental significance for audition. And to a corresponding extent the specificity of the particular fibers activated by a given pattern of stimulation becomes of increasing importance. The analysis of complex tones must be carried out almost exclusively in the cochlea. This emphasizes the importance of understanding in detail the mechanics of the inner and middle ears and their modification in health and disease.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

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ACUTE AND CHRONIC OTITIS MEDIA, SINUS THROMBOSIS AND PETROSAL PYRAMID SUPPURATION

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The literature available this year has a distinct trend toward clinical reports. Of course, one finds the usual case reports stressing some peculiarity of a case. Critically analyzed they present no marked deviation from the usual ones. They rarely merit even the term "atypical," and often they present no new point of view.

A considerable and marked improvement in the literature might result were editorial prerogative exercised more judiciously and the amount of publications reduced. This would cause the disappearance from the journals of many articles whose raison d'être is obscure, and would give a positive result in improving the quality of the publications.

PROBLEMS CONCERNED WITH ACUTE LESIONS

Meltzer,[1] after observations continued over a period of twelve years, and basing his conclusions on many hundreds of dissections and findings at operation on the mastoid process, contends that the mastoid cells, when present, are arranged in a systematic manner, dependent primarily on the course and the position of the lateral sinus. This vessel, in its relationship to the cortex of the squama posterosuperiorly and to the cortex of the mastoid process laterally and posteriorly, influences the cell arrangement. The position taken by the lateral sinus is important for the arrangement of the mastoid cells, moreover, as regards its relation to the digastric crest or medial margin of the mastoid tip inferiorly and to the posterior canal wall from the level of the lateral semicircular canal to the facial nerve ridge. Whether the cells are large or small, pneu-

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1. Meltzer, Philip E.: The Mastoid Cells: Their Arrangement in Relation to the Sigmoid Portion of the Transverse Sinus, Arch. Otolaryng. **19**:326 (March) 1934.

matic, diploic or of mixed type, their general arrangement will be systematic according to the relationship of the lateral sinus to the structures mentioned. The author holds to Wittmaack's theory of pneumatization with the modifications enunciated by Albrecht.[2]

Three groups of cells are distinguishable:

1. The superior group, with two subdivisions: (*a*) the anterosuperior cells spreading along the upper regions of the mastoid process, including both the superficial and the deep zygomatic cells; (*b*) the postero-superior cells, those located at the angle and the petrosal cells, including those just under the mastoid tegmen.

2. The antero-inferior group, also with two subdivisions: (*a*) the cells of the mastoid; posterior canal wall, and the tip; (*b*) the retrofacial cells, which lie just posterior and medial to the facial canal.

3. The mesioposterior group, consisting of all the cell structures which lie intermediately and are interposed between the first and second groups mentioned, merging and coalescing with them.

Meltzer's work is of value when operating if the habit is acquired of checking each group of cells, so that when the operation is finished exenteration of all the groups will have been accomplished.

The clinical evidence of involvement of the cells of the mastoid tip in a suppurative process while the remainder of the mastoid remains free from such involvement spurred Almour [3] to investigate the problem. It is an established fact that the mastoid cells communicate with one another, and with the advent of purulent otitis media, as Schiebe long ago demonstrated, there usually occurs a general involvement of the entire mastoid process in the lesion to a variable degree. It has been observed many times that with the onset of the tympanic suppuration there was an outstanding tenderness of the mastoid tip cells. In addition, at operation these cells often showed marked necrotic coalescence far advanced over that observed in the remainder of the mastoid process. Almour found, by means of a simple experiment, that the tip cells have a separate and distinct tract of communication with the tympanic cavity. This experiment clarified the mechanics of invasion for the type of clinical picture just alluded to and explained the operative findings in these cases. The tract, he found, corresponds roughly to the tract termed "retrofacial" by Meltzer.

A discussion of the time when surgical intervention is most beneficial in its results engaged the Section of Otology of the Royal Society of

2. Albrecht: Acta oto-laryng. **14**:221, 1930.

3. Almour, Ralph: The Evolution of the Mastoid Tip Cells as a Cell System Separate from the Remainder of the Mastoid Cells, and Its Significance, Laryngoscope **43**:797, 1933.

Medicine, London.[4] The opinions expressed, which are summarized in the reports of Watson-Williams,[5] Williams[6] and Wood,[7] were that no hard and fast rule can be established which may be applied to all cases. Too many factors enter into the picture, and too wide differences occur. Signs, symptoms and indications for operation overlap, and types cannot be classified sharply. That types of influenzal epidemics change from year to year and sometimes during a current year is well established; and the severity of the otitic symptoms changes correspondingly. I may add that the age of the patient infected is also a factor in the time at which surgical intervention is most urgently required. Thus, aged and constitutionally diseased people are not to be subjected to too long a wait after the onset of a lesion lest intracranial invasion take place.

Watson-Williams contributes the further thought that, except as a complication of influenza chronic suppurative otitis rarely occurs in adults. Influenzal chronic suppurative otitis usually develops in the first two years of life.

There is another observation which will strike the average American otologist as rather unorthodox. Howell [4b] is of the opinion that, aside from giving relief from otalgia, paracentesis in itself is of very little value, that it does not prevent involvement of the mastoid cells and that healing is not better after it than in cases in which paracentesis is not done. In the ensuing discussion Tweedie [4c] concurs in these observations, while Hastings,[4d] also agreeing that paracentesis does not prevent the development of mastoiditis, holds that when it is properly done and correctly timed, there result not only fewer operations but quicker and more complete healing, and often a chronic perforation is avoided.

Atkinson [4e] brings evidence from a large hospital for patients with infectious diseases. He reports that he was obliged to perform only two antrotomies in seven years. A somewhat similar experience is that of Burt Hamilton,[4b] whose observations extend over a period of ten years in the Contagious Hospital in Manchester. He is in agreement as far

4. (*a*) Discussion on Early or Late Operation in Acute Mastoiditis, Proc. Roy. Soc. Med. **26**:729, 1933. (*b*) Howell, Nancy G.: The Value of Paracentesis in the Acute Specific Fevers, ibid. **26**:572, 1933. (*c*) Tweedie, A. R., in discussion on Howell, p. 573. (*d*) Hastings, Somerville, in discussion on Howell, p. 574. (*e*) Atkinson, J. A., in discussion on Howell, p. 574. (*f*) Hamilton, E. S. Burt, in discussion on Howell, p. 575. (*g*) Stuart-Low, F., in discussion on Howell, p. 575.

5. Watson-Williams, E.: Otorrhea, Brit. M. J. **2**:47 (July 8) 1933.

6. Williams, Horace J.: Otitis Media in Scarlet Fever, Arch. Otolaryng. **17**: 235 (Feb.) 1933.

7. Wood. V. V.: Acute Mastoiditis—Early Operation or Delayed, Ann. Otol., Rhin. & Laryng. **42**:241 (March) 1932.

as scarlatinal otitis is concerned. For other forms he believes in a timely paracentesis. Finally, Stuart-Low [48] points out that the reason that one sees so many cases of chronic otorrhea is that proper and timely paracentesis is not performed often enough. In contrast to these British observations, Williams reports on a series of 14,733 patients with scarlet fever, of whom 10.8 per cent had purulent otitis and 1.1 per cent required surgical intervention. He found that paracentesis, when indicated, tends to lower the incidence of surgical intervention.

To me, who correlates clinical data with the underlying pathologic changes, including those in the bone structure, which influence the character of the lesion presented in a given case, the level of this discussion seems strange. It is well recognized that paracentesis does not prevent the development of mastoiditis and that the evolution of chronicity rests on essentially different factors than failure to provide early and adequate drainage of the middle ear. It is now rather well comprehended that a chronic mastoiditis is a clinical entity with its own significant pathologic process from the onset. It is dependent on the bone structure of the tympanic and mastoid areas and on whether or not the original lesion attacks the epitympanic space. Chronicity does not generally develop from an acute invasion, except in the case of the acute necrotic otitis of Wittmaack and of fistulas into the petrosal pyramid. It is rather to be regretted that in this pertinent discussion, in which men of extensive experience gave evidence on a surgical procedure, they did not review the clinical material on which they based their observations in the light of Wittmaack's well established fundamentals.

However, this discussion may help to eradicate the practice, still prevalent among some pediatricians in this country, of repeating paracentesis occasionally in a vain and thoughtless effort to avoid resort to antrotomy or mastoidectomy—a procedure which I have repeatedly deprecated because of its failure to accomplish the ends sought and because it handicaps hearing.

Meyer-Liselotte [8] analyzed the temperature curve in 200 cases of purulent otitis in children. He found that afebrile cases are extremely rare in childhood, that the temperature curve is higher in cases of bilateral otitis than in the unilateral infections, and finally that the temperature curve is not to be considered an index of the severity or extent of the lesion. The temperature curve is an individual reaction; it may be low in severe cases, or the opposite may occur. The general clinical findings and the local findings in the ear are of more importance than the temperature chart.

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8. Meyer-Liselotte: Ueber den Temperaturverlauf der akuten Mittelohreiterung des Kindes, Arch. f. Ohrenh-, Nasen- u. Kehlkopfh. **135**:77, 1933.

In connection with temperatures, particularly in infants and young children, Leidler [9] calls attention to an observation which is noteworthy. He observed tachycardia in most cases in which septic temperature curves are exhibited. He designates this tachycardia as very characteristic. Its onset is coincident with that of the intermittent fever, and there are alternating periods of well-being and deep apathy, paleness and transient erythema. The presence of tachycardia at the commencement of otitis is to be regarded as a grave sign. The tachycardia outlasts the sepsis for a considerable period.

Hofer [10] divides otogenous sepsis in infants into two types: the pyemic type, accompanied by multiple foci of infection, high fever, chills and the general picture of sepsis, and the septic type, with a continuous high fever but no demonstrable foci. Metastatic lesions in children usually are located in the lungs; often the lungs and the ears are involved simultaneously.

In a study of the lesion Karbowski [11] reports as follows: (*A*) the infection follows the blood channels and not the surface of the eustachian tube; (*B*) changes, especially in young children, are more frequently seen in the mastoid process, the middle ear being almost free from characteristic lesions, and (*C*) characteristic lesions are found only in pronounced cases, and in these the internal ear as well as the middle ear contains lesions. His studies were chiefly concerned with children with an allergic tendency.

The observation that the middle ear often escapes a characteristic lesion in these septic children reported on by Karbowski brings the study made by Love [12] into prominence. Love states that mastoiditis without tympanic involvement has often been reported and that primary mastoiditis has its established place in otology. He advances the knowledge of the subject by reporting 9 cases of complications secondary to primary mastoiditis. In all of his cases the tympanic cavity presented an unruptured membrana tympani.

Primary tuberculous otitis is sufficiently rare to warrant perusal of the report of Despons,[13] who draws attention to the fact that tubercu-

9. Leidler, Rudolph: Die otogene Sepsis im Kindesalter, Wien. klin. Wchnschr. **46**:1128 (Sept. 15) 1933.

10. Hofer, I.: Otogene Allegemeininfection im Saüglings- und Kindesalter, Wien. klin. Wchnschr. **46**:1426 (Nov. 24) 1933.

11. Karbowski, R.: Pathologisch-anatomische Studien ueber Erkrankung des Gehörorgans im infektiös-toxischen Symptomkomplex bei allerjuengsten Kindern, Polski przegl. otol. **9**:314, 1933.

12. Love, Andrew A.: Complications of Otitis Media Without Rupture of the Membrana Tympani, Arch. Otolaryng. **17**:297 (March) 1933.

13. Despons, J.: Sur un cas de tuberculose primitive de l'oreille chez l'enfant, Rev. de laryng. **54**:387, 1933.

losis of the ear in a child is observed clinically as acute otitis media with fever, which then develops into acute mastoiditis. The evolution of the lesion seems slower, and the duration of the acute stage is longer, than in other forms of otitis. This, he believes, suggests the tuberculous nature of the process. He reports a case in point. More than one operation is usually found necessary to heal the aural lesion. Diagnosis is made by histologic study of the lesion taken from the infected area.

While on the subject of tuberculous otitis, let me call attention to the recommendation of Muskat,[14] who believes that the eradication of a tuberculous lesion in the middle ear or mastoid process calls for radical mastoidectomy rather than for a conservative measure. He stresses this particularly for tuberculous patients who have ear lesions.

Kobrak,[15] who studied the relationship between the pathogenesis and the clinical aspect of tuberculosis of the middle ear holds to the view that the middle ear invasion is by the hematogenous route but does not entirely disregard the claims of the opponents of this theory. Kobrak questions the animal experiments on which the theory of hematogenous infection rests. He calls attention to the methods used, for instance, injection of the infecting material into the blood vessels of the neck, and holds that this does not create a situation analogous to that observed clinically in man. In otitic tuberculosis the author believes that the prime factor is not the tubercle bacillus itself so much as the damage caused to the defense mechanism of the body by a nonspecific trauma which causes the lesion to locate in the middle ear. The less virulent the acute infection, the more the tuberculous factors step to the front. The tuberculosis is the underlying latent condition which dominates the clinical picture, according to this observer.

Specific otitic lesions have not been reported for some time. Therefore, the reports of Guillermin [16] and Mounier-Kuhn and Euvard [17] are important. Guillermin characterized syphilitic mastoditis as a chronic condition with sequestra formation. He reports a characteristic case, in which in addition to these findings there was a large exposure of the dura. He believes that middle ear infections in syphilis are independent of the syphilitic infection. The bone lesion, however, is classified as syphilitic. Mounier-Kuhn and Euvard present a survey of the material, since 1790 and report 30 cases from the literature. They add 3 cases to the record.

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14. Muskat, Irving: The Eradication of Chronic Tuberculous Middle Ear and Mastoid Disease in a Tuberculous Patient, Am. Rev. Tuberc. **28**:447, 1933.

15. Kobrak, F.: Beziehungen zwischen Pathogenese und Klinik der Mittelohrtuberkulose, Internat. Zentralbl. f. Ohrenh. **36**:271, 1933.

16. Guillermin: Mastoidite syphilitique, Ann. d'oto-laryng., 1933, no. 1, p. 72.

17. Mounier-Kuhn, P., and Euvard, P.: Syphilis of the Mastoid and the Mastoid Region, Rev. de laryng., 1933, p. 734.

Last year I called attention to the work of Engel,[18] who reported on otogenous peritonsillar abscesses. Keleman [19] describes a case in which, in connection with acute otitis media, there developed an abscess which located under the bony external auditory canal and spread backward toward the posterior and lateral surfaces of the pharyngeal wall and along the sternocleidomastoid muscle. These findings in the throat are of special significance. Their pathologic import is often not comprehended. Abscesses of the lateral pharyngeal wall should always be examined not only as to their possible relationship to middle ear infections but also (I saw two such cases) as to the possibility that they may be gravity abscesses from an otherwise unrelieved suppuration of the petrosal pyramid, to which further reference will be made later.

To the publications of Weill and Nevolnikova,[20] Rosenwasser and Druss [21] add cases to draw attention to the fact that unless the diseased zygomatic root is removed at the mastoidectomy the operation is incomplete, delayed healing may result and complications, both in the meninges and in the brain, may ensue.

Finally, another observer reports on the results of timing the surgical intervention on the mastoid process. This engaged my attention last year. The report of Guthrie [22] adds valuable data. After studying Neuman's report on an analysis of 1,300 operations, he presents data which accord with Neuman's findings based on 151 cases of his own. They were all cases of acute mastoiditis in children. In the cases in which those operations were performed during the first week of the infection 25 per cent of the patients had complicating lesions, and the mortality rate was 8.3 per cent. In those in which operation was done during the second and third weeks the figures were much lower, and in those in which operation was done during and after the fourth week, the results were still better.

There are two plausible explanations for these findings. In cases of severe onset and rapid development, the clinical state of the patient is so dubious as to force operation early, when the patient is prostrated with the bacterial invasion and before body defenses have properly been

18. Engel, F.: Peritonsillärer Abscess otogenen Ursprungs, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **19**:303 (Oct.) 1932.

19. Kelemen, G.: Zur Pathologie des otogenen parapharyngealen Hals Abscesses, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **33**:600, 1933.

20. Weill, G. A.: Le phlegmon zygomatique sous-temporal, Oto-rhino-laryng. internat. **15**:482, 1931. Nevolnikova, L.: Zur Klinik der Zygomatitiden otogenen Ursprungs, Zhur. Ushn., Nos. i Gorl. Bol. **8**:527, 1931.

21. Rosenwasser, Harry, and Druss, Joseph G.: Zygomatic Infections as a Factor in Otitic Complications, Arch. Otolaryng. **17**:625 (May) 1933.

22. Guthrie, Douglas: Early or Late Operation in Mastoiditis, J. Laryng. & Otol. **48**:400, 1933.

established. Added to this, there necessarily ensues the shock incidental to the surgical therapy applied. Furthermore, as I have pointed out, nature's walling-off has usually not been established; hence, the high incidence of complications and the high mortality figure which Guthrie reports in these cases.

On the other hand, when operation is indicated later in the course of the disease, it is obvious that the lesion is developing more slowly and more gradually; hence the body defenses have become better established and the patient is in better condition to meet the unavoidable surgical trauma and shock. Of course, it is comprehended that Guthrie is dealing with and reporting on his own observations. He does not delay operation in some cases and operates earlier in others just for purposes of comparison. He has his standard for surgical indications, and when he operates early it is because the patient's condition, as it presents itself, demands early intervention. In other words, there is a degree of severity of onset and rapidity of evolution of the mastoid lesion which determines the time at which surgical intervention becomes necessary; and his report compares the results that ensue. With his conclusions I find myself in accord.

Ridout,[23] reporting on 196 operations, advocates very early operation. On reading this report, however, there seems to be considerable confusion in the ideas presented on the pathologic process, and the conclusion seems an opinion rather than a considered and matured observation. The mortality is given as 1.5 per cent. I feel that the bacterial flora involved, the strict interpretation of what constitutes surgical mastoiditis and other clinical factors are not taken into account by Ridout. To cite an extreme example, it is possible to have a low mortality if one operates for otitis media rather than in the stage of fully developed mastoiditis. Comparing these two reports, Guthrie's deductions warrant more serious consideration.

Curcio [24] examined 60 patients with acute and 40 with chronic otitis and studied the differences in the size of the pupils. I shall detail his findings in the acute cases only. In the 60 acute cases, anisocoria was found 12 times, mydriasis 7 times and myosis 5 times. He advances the explanation that the myosis follows pressure of the exudate on the fibers of the sympathetic nerve in the middle ear, producing paralysis of these nerve fibers. The condition usually accompanied a perforated drum-head, but nevertheless there was inadequate drainage of the middle ear. Typical mastoiditis was absent.

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23. Ridout, C. A. Scott: Early or Late Operation in Acute Mastoiditis, J. Laryng. & Otol. **48**:408, 1933.

24. Curcio, Gaetano: Reazione pupillare nelle otiti medie purulente, Oto-rino-laryng. ital. **3**:533, 1933.

The combination of mydriasis and sharp pupillary reactions he comprehends as an expression of irritation of the dilating fibers. This was found in patients who presented irritative signs from the labyrinth—vomiting, dizziness and nystagmus. A few days postoperatively the pupils were again normally equal.

Curcio concludes that in the floor of the tympanic cavity there are fibers from the sympathetic nerve, and he believes that signs obtained from the pupils are significant indicators for operative intervention. These signs take on special significance in traumatic cases. They bespeak an injury involving the mucous membrane of the tympanic space and should be considered as an indication for operation.

PROBLEMS CONCERNED WITH INTERMEDIATE LESIONS

There are lesions which cannot be considered in the acute class; neither are they of the chronic type, since chronic lesions are now comprehended as constituting a distinct pathologic entity rather than as a clinical process which runs a protracted course; in the literature this type of case is often recorded as one of "latent mastoiditis." I have never quite comprehended this term from a pathologic standpoint. It is necessary, nevertheless, to note some such reports. Thus Bilinkis,[25] on the basis of histopathologic examinations of material obtained from trephinings and scrapings from wounds and a study of clinical data, concludes that the characteristic lesions of latent mastoiditis are proliferative excrescences which are so strong as to overcrowd the exudative process in the mastoid lesion. Thus histopathologic changes run their course while clinically there are no symptoms. The roentgenograms are the greatest help in diagnosis.

This observation of Bilinkis can be contrasted with that of Taptas,[26] who explains that "mastoiditis latens" is brought about as a result of the characteristics of the eustachian tube. When the perforation of the drum heals quickly and the tubal patency is reestablished, or when the tube is shut off only transiently, the secretions in the mastoid cells do not drain off adequately and there results a diffuse osteitis of the temporal bone. Taptas considers as latent mastoiditis every simple middle ear infection which, even if it does not produce pus, shows a distinct tendency to heal and bring the ear toward normal anatomic and functional activity. He adds that he considers operation necessary after three weeks of observation of such cases.

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25. Bilinkis, G.: Clinical and Histopathological Studies in re Latent Mastoiditis, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **21**:288 (Sept.) 1933.

26. Taptas, N.: Die latent Otitis und Mastoiditis (Mucosus-Mastoiditis), Ztschr. f. Hals-, Nasen- u. Ohrenh. **33**:559, 1933.

I have repeatedly, in these reviews, taken the position that there is no significant pathologic process that can be characterized as latent mastoiditis. A lesion is either active or in process of recession and healing. And the reports here noted do not present reasons for a change in this opinion. There is confusion because there are asymptomatic lesions which run a course, unless relieved surgically, toward intracranial complications. The reports cited concern themselves with a study of these asymptomatic lesions.

One of the lesions of the asymptomatic type most often observed is that produced by so-called Streptococcus mucosus. Because of the difficulty in making an accurate diagnosis with such an invading organism present, Rollin [27] stresses the need of both smears and cultures before diagnostic identification can be positively established. He calls attention to the clinical observation that in the course of mucous otitis, the fifth week presents the most critical period. The tendency of the invasion to reach and infect the perilabyrinthine cell tracts and the peripheral cell tracts is characteristic. Rollin reports six cases in which, after an apparently harmless middle ear infection, the patient eventually died. He found three types of intracranial invasion: (1) rupture into the labyrinth, (2) rupture through to the porus acusticus internus and (3) direct spread to the dura. His final observation is significant. He found that too early operation makes the danger of meningitis greater than with later intervention. Two of his patients had unilateral headache and abducens paralysis and died without recognition of the lesion, which was located in the petrosal pyramid, before the terminal meningitis developed. I shall refer to these cases later.

The reports of recurrent mastoiditis lead to some interesting discussion. There must, of course, be a differentiation between a reinfection of the mastoid process and a recurrence of an acute clinical picture during the course of healing of mastoiditis. In reinfection the lesion has been healed completely, and, owing to one or more of any number of factors, there occurs a new infection at the site of the former lesion, with a breakdown and a reappearance of symptoms which may make surgical intervention again necessary. When a recurrence of symptoms appears demanding operation, during the original postoperative period, there is a different lesion. Among the latter type of lesions may be noted localized involvements of the zygomatic root, sequestra formations and encapsulated areas which have broken down subsequent to the original operative procedure and present stormy clinical signs.

With this definition of terms in mind, I should classify Helman's [28] report as being a description of a secondary infection rather than of a

27. Rollin, Heinz: Beiträge zur Kenntnis der Mucosus Otitis, Arch. f. Ohrenh. **137**:333, 1933.

28. Helman, D.: Rezidivierende Mastoiditis, Polski przegl. otol. **9**:305, 1933.

residual one. He observes that residual mastoiditis is seen more often in small children than in older ones. In the early days, the residual infections are easily healed. In the later stages, there develops a subcutaneous, or a "scar," abscess; after this is opened, healing occurs. With the presence of greater virulence and other factors (constitutional), the infection advances further so that at the time of the second mastoidectomy there is found a large bony defect with a wide communication between the mastoid cavity and the middle ear, filled with granulations, pus, detritus and connective tissue. The later the reinfection (for example, if from three to five years have intervened since the original operation) the more new bone deposits will be found. Eventually, if repeated reinfections take place, the bone seems to lose its power of regeneration. The causes for these reinfections are not clearly established.

Christukat,[29] who studied a series of such cases for ten years, believes that no one cause for reinfection can be found. The essential factor in each case must be established individually. In the 98 cases included in his report, among which there were 53 in which secondary operations were performed, he found cells remaining in situ 25 times and there was a secondary cholesteatoma 11 times.

I doubt that cell structure is the cause of recurrence or reinfection because it has been established by Voss,[30] Loebell [31] and others that cellular development may occur after mastoidectomy. The finding of cholesteatoma is due to other factors. Reinfection remains an unsolved problem.

As knowledge stands at present, the preventive measures presented in the conclusions of Lacy [32] deserve attention. Lacy's conclusions are as follows: 1. The mastoid antrum should be traumatized as little as is consistent with good surgery and good end-results. 2. Special pains must be taken to eradicate all diseased material, particularly in the zygomatic and the mastoid tip areas. 3. In the postoperative care one should endeavor to obtain a healed cavity completely filled from the antrum to the surface. 4. Recurrences, he believes, are, in the last analysis, the result more often of extraneous pathogenic circumstances than of faulty operative technic.

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29. Christukat, Alfred: Ueber Nachoperationen bei Antrotomien mit besonderer Berücksichtigung der in der Universitätsklinik für Ohr, Nasen und Halskunde, von 1919 bis 1929 behandelten Fälle, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **22**:43 (Jan.) 1934.

30. Voss, in discussion on Steurer, Ztschr. f. Hals-, Nasen- u. Ohrenh. **29**:113, 1931.

31. Loebell, H.: Ohroperationen im frühen Kindesalter und Pneumatisationsentwicklung, Ztschr. f. Laryng., Rhin., Otol. **21**:326, 1931.

32. Lacy, N. Eugene: Recurring Mastoiditis, Ann. Otol., Rhin. & Laryng. **42**: 527 (June) 1933.

PROBLEMS CONCERNED WITH CHRONIC LESIONS

Since it is established that chronicity of a middle ear lesion is in itself usually evidence of a pathologic entity and not a prolonged duration of a lesion originally acute which failed to respond to treatment, it is pertinent to note the study of Almour [33] who, basing his work on Wittmaack's theory of pneumatization, draws practical conclusions valuable in handling these chronic lesions.

Almour accepts the Wittmaack theory and restates it, showing by histologic studies the stages in the development of normal pneumatization. This knowledge is now better comprehended than a few years ago and needs no repetition here. When pneumatization is interfered with, or interrupted, two types of temporal bone result: (1) the infantile, or diploic, type and (2) the sclerotic type. Of course, it is understood that there are mixtures of types dependent on the stage at which interference with pneumatization takes place.

Almour does not view sclerosis of the mastoid bone as a pathologic process in the sense that it is the lesion producing the chronic otorrhea. It is a concomitant finding, however, in most chronic cases. He therefore does not remove the sclerotic bone when doing a radical operation on the mastoid because that factor is not producing the chronic otorrhea which all these patients present.

Many efforts have been made to facilitate healing after radical mastoidectomy by utilizing skin grafts and other means. Almour revives a suggestion of Dundes-Grant and uses the cholesteatoma matrix for this purpose, arguing that once egress for the detritus and desquamated epithelial scales is furnished by a large plastic opening, this matrix will revert to its skinlike quality and the surface of the operative cavity will be lined with squamous epithelium in no way different from the epithelial layer of the skin. This procedure also facilitates rapidity in healing.

Lyons,[34] having the same objective in view, uses the amniotic membrane. This is a relatively durable membrane. It has no blood vessels and obtains its nourishment by absorption. It is thin and smooth and adequately suited for a transplant, and can be obtained in considerable size so that a single piece may be used to cover most of the cavity. The membrane is obtained fresh, placed in physiologic solution of sodium chloride and kept in an incubator at body temperature. Donors of the membrane must give negative reactions to both the Wassermann and the Kahn test. The amniotic and the chorionic tissues are kept together until the cavity is covered; then the membranes are separated and the

33. Almour, Ralph: The Practical Application of Wittmaack's Theory of Pneumatization, Ann. Otol., Rhin. & Laryng. **42**:112, 1933.

34. Lyons, Horace R.: The Use of Amniotic Membrane as a Transplant in Radical Mastoidectomy, Tr. Am. Laryng., Rhin. & Otol. Soc., 1933, p. 11.

amniotic surface adjacent to the chorion is placed against the bone, packed in place and left undisturbed for from nine to twelve days. Excessive discharge is cleaned away daily. It requires from four to six weeks to determine whether or not a "take" has resulted. A large wound cavity is desirable. Lyons reports two cases in which the patients were thus treated. The method deserves trial to determine its value.

From my experience, the efforts formerly made to procure a closed eustachian tube are unnecessary. Many of the best healed cavities have patent tubes, and in these cases the ear remains dry. There are still otologic surgeons who bend every effort to close the tympanic orifice of the tube. For such the procedure of Dutheillet and Lamothe [35] will prove interesting. These surgeons, before commencing the operation on the mastoid process, introduce, under vision directed through a salpingoscope placed in the nostril of the opposite side, a long, very thin, cautery needle into the eustachian tube of the affected side. They penetrate about 1 cm. deep and scarify the lumen of the tube. They report only a very slight reaction from the procedure and find the patency of the tube gone after from about eight to ten days. Then they operate on the mastoid. They report a quicker healing of the wound following this procedure.

Guns,[36] for his radical operation, uses an intrameatal technic which he ascribes to Thiess of Leipzig and which was improved by von Eichen. He does not cut a flap, believing that a flap hinders healing, and stresses that removal of the lateral attic wall and widening of the antrum are all the operation on the bone needed. He professes to see quicker healing and the earlier advent of ambulatory treatment by this method. The intrameatal operation on the attic for chronic lesions has been well established in this country by Tobey and his school. By what reasoning Guns can claim 60 per cent better results as to hearing acuity by this operative procedure, however, is not clear.

Thiess [37] Jr. contributes a report covering the intrameatal type of operative procedure developed by his father. The report covers the period from 1907 to 1933. In 11.5 per cent of the cases cholesteatoma was present. The others were cases of disease of the mucous membrane and lesions in the underlying bone. Of the 172 cases of cholesteatoma, in 17.4 per cent the process had extended into the cranial cavity, in 7.6 per cent it had invaded the vestibular apparatus and in 29.4 per cent it had spread over the tympanic cavity and the attic area. Of 1,318 cases

35. Dutheillet and Lamothe: Mon procédé pour obstruer la trompe d'eustache au cours des évidements pétro-mastoidiens, Ann. d'oto-laryng., 1933, no. 6, p. 693.

36. Guns, P.: La cure radicale des otorrhées chroniques par le conduit et ses resultats physiologiques, Rev. de laryng. **54**:1102, 1933.

37. Thiess, Fritz Jr.: Die Radikaloperation durch den äusseren Gehörgang, Ztschr. f. Hals-, Nasen- u. Ohrenh. **33**:459, 1933.

without cholesteatoma in only 8.9 per cent did the lesion invade the cranial cavity; in 1.9 per cent there were fistulas of the semicircular canals, and in 33.9 per cent the lesion encompassed the entire area of the mastoid process. The author finds little difference between the chronic lesions with, and those unaccompanied by, cholesteatoma.

Because of bad granulations and polypoid excrescences, 10 patients needed a secondary operation. One patient presented facial paralysis before operation, and in 9 a slight facial paralysis resulted from the operation. The author ascribes these paralyses to the technic of applying local anesthesia. With this observation I am not in accord. I think it more likely that the facial nerve was traumatized owing to the limited operative area through the conchal meatus.

The author subjected 84 patients to a more recent reexamination and found that 70 of them were cured. Twelve still have suppurating ears, and 2 others have severe middle ear suppurations. He reports the hearing improved in 41 and worse than previously in only 3.

The radical operation through the external auditory canal comes into question when a chronic suppuration of the middle ear is limited to a suppuration in the attic, the antrum or the mastoid which does not yield to conservative treatment. Thus does Thiess fix his indications. In addition, he feels that there should be no complication from the brain or from a sinus. He stresses one more point. The operation is indicated when no coalescence is presented in the mastoid process. This point should be remembered by those who advocate the intrameatal operation on the mastoid for acute cases with coalescence of mastoid cells.

The question of how best to handle the perforation in the membrana tympani after chronic suppuration has engaged the attention of Dundes-Grant,[38] who employs trichloracetic acid for the purpose. He has secured healing of the drum and almost normal hearing.

In the procedures for radical mastoidectomy the chorda tympani is usually sacrificed when removing the remains of the drum-head and tympanic ring and rests of the ossicular chain. Clinically, disturbances of the function of taste are rarely observed. This question interested Altmann and Löwy,[39] who report a series of investigations on the problem. They found that if 3 cc. of a 10 per cent solution of iodine is injected into a healthy ear in from two to four minutes, iodine will appear in the saliva on both sides of the mouth; and after from thirty to forty minutes the entire amount of iodine injected is excreted. The

38. Dundes-Grant, James: Closure of Large Perforation of Life-Long Duration by Means of Trichloracetic Acid, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **21**: 600, 1933.

39. Altmann, F., and Löwy, K.: Klinisch-experimentelle Untersuchungen ueber die Funktion der Mundspeicheldruesen, besonders nach Radikaloperation des Mittelohres, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **21**:316 (Sept.) 1933.

identification of the iodine is accomplished as follows: On a small cotton swab saturated with a strong solution of sodium nitrate and a mild solution of acetic acid, a blue color appears at the ductus submaxillaris.

Altmann and Löwy examined 11 persons in this way after radical mastoidectomy. No difference was noted between the operative and the healthy side. Under the handicapping influence of atropine, or the enhancing stimulating effect of pilocarpine, there were equal results on the operative and healthy sides.

These experiments indicate that the secretion of iodinized saliva is not dependent on action by the chorda tympani. The secretion depends, more likely, on the parasympathetic nervous system. Of the 11 patients only 3 showed some differences in the reactions on the two sides under the influence of physostigmine. The results are construed as showing the independence of the salivary glands from the chorda tympani.

In closing this section on problems concerned with chronic lesions, one may note that Curcio [24] observed myosis on the side affected in most of the 40 cases that he studied. The pupil on the same side reacted less vigorously to light than that on the normal side. Following radical mastoidectomy, this condition persisted for some time, but the pupils reacted equally in most instances at about the time the wound cavity was healed.

The problem of preserving hearing by ultraconservatism regarding radical mastoidectomy has long been in vogue among otologists. Olaison [40] reports what is usually found. In his experience hearing is about the same after as before operation. The majority of reports indicate that hearing is somewhat more impaired after than before radical mastoidectomy. Those otolaryngologists, myself included, who are following the school of thought that holds that chronic mastoiditis is a lesion with its genesis at birth, in a disturbed pneumatization, while the inciting factors are infections during the exanthemas, believe that the greatest loss in acuity of hearing takes place during the continuation of the so-called conservative treatment and that when, later in life, operation becomes a vital necessity, the hearing loss is already established. On the other hand, when the cases are recognized for what they pathologically are early in their evolution and operation is undertaken, there is a conservation of hearing acuity rather than a loss. At least, that has been my experience.

PROBLEMS CONCERNED WITH LESIONS OF THE VEINS

The problems concerned in infections of the venous blood stream are stabilized, and there is little that is new; nor is there much contro-

40. Olaison, F.: Indications for Operation in Chronic Otitis, Nord. med. tidskr. **5**:591, 1933.

versy regarding the questions at issue. Probably Greenfield [41] summarizes the matter as well as any of the authors of available reports. Speaking of the routes over which the infection travels, he gives the following outline: (1) through the middle ear, the mastoid process, to the lateral sinus; (2) from the floor of the tympanic cavity to the bulbus venae jugularis, especially in children and young adults; (3) by direct involvement of the mastoid emissary vein; (4) in connection with a thrombosis of the sinus petrosus inferior—which may result from spread from a lesion in the internal ear and the veins of the internal ear or from necrosis of cells of the tip of the petrosal pyramid; (5) by direct inclusion in the lesion of the sinus petrosus superior through veins of the tegmen tympani et antri—and the sinus petrosus superior is also reached by vessels going through the sutura petrosquamosa; (6) through various canaliculi which lead from the mastoid process toward the endocranium, particularly through anatomic variations (dehiscences, etc.) and diploic veins, and finally by vessels which follow the lymphatic system.

With this general outline in view, added data regarding diagnosis become important. The most interesting report is that of Fleischman,[42] who found that, when there is sinus thrombosis on one side, of course the great amount of blood returned from the head flows through the internal jugular vein on the healthy side. Because of the rich collateral blood channels, choked disk is rarely observed. If one hinders the free flow on the healthy side by compressing the internal jugular vein, there is immediately evident a remarkable engorgement of the veins in the optic disk on the diseased side. If there is no obstructing thrombus, no changes in the fundus are noted. The most marked fundus changes are noted when both internal jugular veins are compressed. By means of this test, which in essence is a variation of the principles involved in the Tobey-Ayers procedure, obstructing thrombosis and bulbar thrombosis can be diagnosed. While I think the test a valuable addition to the diagnostic measures, I believe that one will find the same exceptions and contradictions in readings as are usually found in the Tobey-Ayers test.

Ziegelman [43] stresses the surgical importance of the mastoid emissary vein in infected sinus thrombosis and reports 2 cases in point. He examined 30 mastoid emissary veins. He feels that in any case in which an infection of the lateral sinus is suspected, examination of the emissary vein should be undertaken; and when it is found involved

41. Greenfield, Samuel D.: Bacteremia of Otitic Origin; Routes of Infection to the Blood Stream; Case Reports with Recovery, Laryngoscope **43**:646, 1933.

42. Fleischman, L.: Zur Pathologie und Therapie der Sinusthrombose, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **21**:731 (Dec.) 1933.

43. Ziegelman, Edward F.: Surgical Importance of the Mastoid Vein in Infected Lateral Sinus Thrombosis, Arch. Otolaryng. **18**:298 (Sept.) 1933.

in a thrombotic lesion, it should be ligated to limit the spread of the infection. The vein was not found in 25 per cent of his examinations.

Kerekes [44] reports on 45 clinical cases of otogenous sepsis with sinus complications and osteophlebitis. The author stresses that early operation in such cases gives the best results. He is thus in accord with Körner and others who have studied the sepsis due to osteophlebitis.

Gioacchini [45] also submits a report on osteophlebitis. He cites the case of a man 76 years of age in whom, following mastoidectomy performed for an acute suppurative middle ear lesion, pyemia developed, accompanied by chills, fever and a secondary abscess in the left knee joint and the right shoulder joint. Death followed a lingering illness of ten weeks' duration. The operative wound showed no reactions. The lateral sinus looked normal and pulsated. The author believes that he was dealing with a case of pyemia without phlebitis of the lateral sinus in the sense which Körner described. This observer speaks critically of the various efforts to prove Körner's contention and comes to agreement with him. He found that he was dealing with phlebitis of the small veins of the temporal bone and that there was also a real osteitis with injury to the blood vessels in the bone like that described by Strazza. I may not question his pathologic reports, but his clinical evidence is certainly unconvincing. An exposed but normal sinus does not pulsate, and the outside appearance of the sinus wall is not always an indicator that its inner walls are free from either a mural or an obstructing thrombus.

Goldstand [46] describes an interesting abnormality. He reports 5 cases of sinus thrombosis, in 1 of which there was a double left sinus transversus. The author observes that in lesions of the sinuses, after the usual procedures do not yield to treatment, consideration should be given to the possibility of abnormalities. He admits that diagnosis of abnormalities of the lateral sinus presents a difficult problem.

Nodzyncki [47] reports a case presenting a complicated clinical picture of chronic middle ear suppuration with deafness, loss of vestibular function and paralysis of the ninth, tenth, eleventh and twelfth cranial nerves. It required both operation and autopsy to clarify the symptomatology. The findings showed suppuration of the left middle ear

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44. Kerekes, György: Beiträge zur Pathologie der otogenen Sepsis, Orvosi hetil. **77**:982, 1933.

45. Gioacchini, Raoul: Sulla piemia osteoflebitica di Körner, Valsalva **9**:826, 1933.

46. Goldstand, Else: Besonderer Verlauf von Sinus Thrombosen, insbesondere im Hinblick auf abnorme anatomische Verhältnisse, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **21**:785 (June) 1934.

47. Nodzyncki, Thaddäus: Beitrag zur peribulbären Eiterung, Otolaryng. Slavica **4**:256, 1933.

complicated by cholesteatoma and a labyrinthine fistula, the cholesteatoma extending into the hypotympanum and perforating the tympanic floor to form an abscess about the dome of the jugular bulb. There was a sequestra formation which included the styloid process. The abscess formation spread along the outside of the base of the skull and reached the foramen magnum, extending forward to reach the foramen condyloideum. At the condyles there was a second sequestra formation.

Ruttin [48] reports 2 cases of obstructing sinus thrombosis in which free blood was found in the vein in spite of the fact that an obstructing thrombus was present. In the first case, the thrombus was located in the upper and also in the lower part of the blood vessel. These two thrombi were not attached to each other. Between them was free blood, which probably came from the superior petrosal sinus. In the second case, the thrombus was attached to the intima of the vessel, leaving only a small lumen present. For those who use the needle to puncture a questionable sinus to determine the presence or absence of thrombosis, these cases will be warnings of the lack of reliability of the puncture test for establishing a diagnosis.

Brown and Bowman,[49] reporting a case of sinus thrombosis, discuss the genesis of thrombosis of the superior petrosal sinus. They believe that a sign of diagnostic import is the persistence of pain referable to the fifth nerve after the jugular bulb has been cleaned of thrombotic matter. This pain is especially significant when accompanied by septic symptoms. Considering the knowledge of the rôle which fifth nerve pain plays in lesions of the petrosal pyramid, I may add that such a lesion should be eliminated when attaching diagnostic significance to fifth nerve pain as a sign of superior petrosal sinus thrombosis.

Leidler,[50] in reporting a case of thrombosis for which the internal jugular vein was ligated, states that he observed markedly choked disks, horizontal nystagmus, a positive Babinski sign, a positive Oppenheim sign and other symptoms suggestive of a pyramidal tract lesion. The cerebrospinal fluid was normal. The patient remained afebrile. The opinion of Ruttin, who discusses these findings, is that they were the result of intracranial blood stasis and were characteristic of this condition.

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48. Ruttin, Erick: Ueber obturierende Simusthrombose mit freiem Mittelstück, Zhur. Ushn., Nos. i Gorl. Bol. **10**:39, 1933.

49. Brown, John Mackenzie, and Bowman, J.: Case Report of Thrombosis of the Lateral Sinus, Inferior Petrosal Sinus and the Opposite Lateral Sinus, with Postmortem Specimen, Laryngoscope **43**:664, 1933.

50. Leidler, R.: Otitis Media Suppurativa Acuta, Abscessus perisinosus, Thrombophlebitis Bulbi, Sinus Sigmoidei et venae jugularis internae; Intrakranieller Process-Heilung, Monatschr. f. Ohrenh. **67**:350, 1933.

Guillermin, Pomme and Migayron [51] report two cases. In one, after operation on the blood vessels there developed a weakness of the right arm from impairment of the function of the fifth and sixth cervical nerves. The patient recovered. In the second case, there was decided weakness of the right arm and hand, and later in the course of the disease there was weakness of the right leg. This patient also recovered. The author is of the opinion that he was dealing with mild degrees of cortical hemiplegia rather than with an interference with the return flow of blood from the brain. The possibility of small septic infarcts in the cerebral cortex must also be considered.

Finally, Smith reports spontaneous perforation of the sigmoid sinus following mastoidectomy in three cases in which he removed the bony sinus plate to expose the blood vessel for inspection. The author believes that the virulence of the invading organism is the element that causes this rupture, and he concludes that the rupture will occur in a necrosing sinus wall not supported by bone before a thrombus forms. With his views I am not in accord. In his cases there was no thrombus, nor was there septicemia. In exposing the sinus during operation, I have seen rupture follow when gauze was used to pack the wound over the vessel. In the repeated removal of this gauze the wall of the vessel eventually became damaged and ruptured. It is therefore recommended that some nonadhering dressing be placed over the sinus wall and between it. I use rubber dam exclusively for packing, and since I have been doing this I have had no such rupture of sinus walls.

PROBLEMS CONCERNED WITH SUPPURATION OF THE PETROSAL PYRAMID

The problems concerned with suppuration of the petrosal pyramid are assuming a prominent place in otologic literature. Notwithstanding authoritative essays, there still remains considerable confusion regarding the Gradenigo syndrome; and many cases are reported under this heading which, when analyzed, do not show involvement of the petrosal pyramid.

For example, Takaski [52] reports a case of a man 22 years of age who, since the age of 15 years, suffered from chronic otorrhea on the left side. For one month prior to his coming under observation there had been an acute exacerbation, accompanied by vomiting, dizziness and facial paralysis, as well as double vision due to paralysis of the abducens nerve. Eventually a sequestra involving the labyrinthine capsule was removed, and then recovery set in.

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51. Guillermin, Pomme and Migayron: Deux cas de trombophlébite suppurée du sinus latéral droit avec parésie du membre supérieur du même coté, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **22**:126, 1934.

52. Takaski, Maeda: Otogene Abducens- und Facialislähmung mit Labyrinthsequester, Otologia (Fukuoka) **6**:681, 1933.

Retjo [53] observed paralysis of the abducens nerve in two cases of seemingly uncomplicated acute otitis media. In the first case the abducens paralysis came on a few days after mastoidectomy. Roentgenograms disclosed a few unremoved but diseased zygomatic cells which had been overlooked at operation. Recovery ensued. In the second case the paralysis appeared during the acute otitis just after spontaneous perforation of the membrana tympani had occurred.

Perrone,[54] reporting three cases, gives a résumé of the Italian literature and cites the various lesions which can produce the Gradenigo syndrome. He attempts to differentiate between them. His arguments do not differ materially from those presented by Vogel, to which Almour and I called attention in our original communication. Perrone makes the statement that only occasionally is the Gradenigo syndrome caused by a suppurative lesion in the petrosal pyramid.

Mounier-Kuhn [55] reports the case of a patient 25 years of age who had an infection of the right middle ear of four weeks' duration. He exhibited a perforation in Shrapnell's membrane. There ensued severe frontal and parietal headache and paralysis of the right abducens nerve. Roentgen examination showed some loss of trabeculation at the tip of the right pyramid and at the tip of the mastoid process. At operation, the mastoid process was found to be eburnized, with some small scattered cells moderately filled with purulent detritus. The mastoid antrum lay high and was small. The dura over the tegmen tympani was free and uncovered. During the postoperative period, the otorrhea reappeared and then ceased, and healing occurred.

There are additional reports bearing on this point. Ruskin,[56] in his case 1, reports a transient abducens paralysis; yet a critical reading of the published data on this case fails to show anything that could be construed as an involvement of the petrosal pyramid. Ballenger [57] and Piquet [58] also report cases with abducens paralysis but no evident

53. Retjo, A.: Paralysis of the Abducens in Acute Otitis Media: Report of Two Cases, Monatschr. f. Ohrenh. **67**:1247 (Oct.) 1933.

54. Perrone, Pietro: Tre case di sindrome di Gradenigo, Ann. di laryng., otol. **33**:32, 1933.

55. Mounier-Kuhn, P.: Syndrome de Gradenigo; Radiographies; Guérison après trepanation mastoidienne simple, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **22**: 128 (Feb.) 1934.

56. Ruskin, Simon L.: The Venous Circulation of the Petrous Bone and Its Clinical Significance, Ann. Otol., Rhin. & Laryng. **42**:961 (Dec.) 1933.

57. Ballenger, Howard: Petrositis, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **21**: 780 (Jan.) 1934.

58. Piquet, Jean: Ostéite pétreuse profonde, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **21**:727 (Dec.) 1933.

petrosal lesions. On the other hand, Lemaitre and Lemoine,[59] Seydell,[60] Blassingame,[61] Bernstein,[62] Galtung,[63] Ruttin[64] and Moulonguet and Pierre[65] report cases of petrosal suppuration all of which are accompanied by abducens paralysis.

I still hold to the contention voiced in the original communication of Almour and myself that the Gradenigo syndrome is more a part of the meningeal involvement which ensues later in the course of the development of the petrosal lesion than it is significant of a suppuration within the petrosal pyramid. It depends greatly on the time when the condition is recognized. If diagnosis is made early—and it can be made—the case will be recognized as one of suppuration of the petrosal pyramid before meningeal involvement has taken place. If the condition is recognized late, paralysis of the abducens nerve may be present. This in a way accounts for the notation of paralysis of the abducens in so many clinical reports followed by autopsy observations of petrosal pyramid suppuration. The cases were not recognized early enough to prevent intracranial or meningeal development. In other words, suppuration of the petrosal pyramid may occur with or without paralysis of the abducens nerve. This sign is not pathognomonic.

Kopetzky and Almour,[66] in a second communication and further report on cured patients, divide the petrosal lesions into two principal types: those which lead to meningitis—the enclosed encapsulated empyemas of the apex—and those in which, during the evolution of an acute middle ear infection, there develops a chronic type of lesion with a resultant chronic otorrhea. The latter type of case usually shows a fistulous tract which leads into the tip from one or another area of the tympanum or mastoid cavity. In some of these chronic cases healing

59. Lemaitre, and Lemoine, Jacques: Syndrome de Gradenigo (abcès extradural de la pointe du rocher), Zentralbl. f. Hals-, Nasen- u. Ohrenh. **22**:445 (April) 1934.

60. Seydell, Ernest M.: Suppuration of the Petrosal Pyramid, Tr. Am. Laryng., Rhin. & Otol. Soc., 1933, p. 561.

61. Blassingame, Charles D.: Mastoiditis Involving the Petrous Apex, Tr. Am. Laryng., Rhin. & Otol. Soc., 1933, p. 480.

62. Bernstein, Sidney: Report of a Case of Temporo-Sphenoidal Lobe Abscess Containing Streptococcus Hemolyticus Associated with Gradenigo Syndrome, J. Laryng. & Otol. **48**:196, 1933.

63. Galtung, A.: Das Gradenigo Syndrome und die Entzündung in der Pyramidenspitze (Petrositis, Apicitis), Norsk mag. f. laegevidensk. **94**:625, 1933.

64. Ruttin, E.: Zur Klinik und Operation der Pyramidenspitzeneiterung und des periapikalen extradural Abscess, Zentralbl. f. Hals-, Nasen- u .Ohrenh. **22**:204, 1933.

65. Moulonguet, A., and Pierre: Un cas de rochérite (ostéite pe treuse profonde), Ann. d'oto-laryng., 1933, no. 2, p. 190.

66. Kopetzky, Samuel J., and Almour, Ralph: Empyema of the Petrous Apex: Further Observations and Case Reports, Ann. Otol., Rhin. & Laryng. **42**:802 (Sept.) 1933.

will take place without resort to further operative procedures; but healing will be facilitated by surgical measures undertaken to cleanse the fistulous tract. Finally, the postulate is advanced that suppurations of the petrosal pyramid in pneumatized bones is a complication of acute suppuration of the middle ear rather than of suppurative mastoiditis.

It has not been my custom to review the roentgenologic literature, but because of the importance attached to it in the study and diagnosis of petrosal suppurations, it is necessary to comment on a few reports. Interpretation of roentgen films must be correlated with the clearcut clinical picture of the cases. Diagnosis based on the roentgen films alone is apt to lead to serious errors. Every evidence of clouding, osteoporosis or absorption of the intracellular trabeculae must not be construed as diagnostic of petrositis in the clinical sense.

Sussman [67] believes that the roentgen view which theoretically should be of most use is that which presents these structures with the least distortion. This view is the one which shows the pyramid from in front perpendicular to its axis—the well known Stenver position. For those who have worked in the field the Stenver position alone is inadequate to make an accurate diagnosis. It shows only the superior margin of the pyramid and whether this is intact or not. Taken in connection with other exposures it is extremely helpful.

Epstein [68] recommends that three exposures be made: (1) according to the method of Schüller, (2) according to the method of Mayer and (3) according to the method of Stenver.

Taylor,[69] who has worked with my associates and me, gives an adequate method. At the commencement of the lesion in the middle ear spaces, a base plate is taken which shows both petrosal pyramids. This is filed for future comparisons. Later, when and if significant signs from the lesion in the pyramid arise, a base plate is taken again and a Stenver plate is also taken. Comparison of the appearance of the diseased side with that of the unaffected side, and with the original first plate, gives the data for the roentgenologic opinion.

The most characteristic clinical sign of petrosal suppuration is the pain in and about the eye. This sign has been studied by Vail,[70] whose studies show the close relation between the great superficial petrosal

67. Sussman, Marcy L.: A Simple Technique for Roentgen Examination of the Petrous Pyramid, Am. J. Roentgenol. **30**:415 (Sept.) 1933.

68. Epstein, H.: Roentgenology in Gradenigo's Syndrome: Report of a Case, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **135**:351 (July) 1933.

69. Taylor, Henry K.: Suppuration of the Petrous Pyramid, Arch. Otolaryng. **18**:458 (Oct.) 1933. Taylor, Henry K.: The Roentgen Findings in Suppuration of the Petrous Apex (Petrositis), Am. J. Roentgenol. **30**:156 (Aug.) 1933.

70. Vail, Harris H.: Vidian Neuralgia with Special Reference to the Eye and Orbital Pain in Suppuration of the Petrosal Pyramid, Arch. Otolaryng. **17**: 212 (Feb.) 1933.

nerve and the interior of the pyramid. Vail states that impulses pass along the great petrosal nerve and by way of the sphenopalatine ganglion anastomose with the terminal branches of the ophthalmic division of the fifth nerve. He supports his contention by reporting three cases to demonstrate that irritation of the vidian nerve in the floor of the sphenoid sinus causes the orbital pain. He thinks that the great petrosal nerve, rather than the ophthalmic division of the fifth nerve, causes the characteristic orbital pain exhibited in suppuration of the petrous pyramid.

While not reported as related to petrositis, the experiment of Fioretti [71] is suggestive. In a patient with chronic otitis media and cholesteatoma, this observer was able, after he had opened the tympanic area surgically, to cause pain in and about the eye by irritating the region of the eustachian tube. The author theorizes about the production of this pain. He concludes that the pain, when it occurs without any other accompanying clinical symptoms, is due to an irritation of the sympathetic nerve in the pericarotid plexus, the irritation eventually reaching the ciliary ganglion.

As pointed out in my last publication,[72] there are two types of cases: the ones in which the petrositis is encapsulated and acute and constitutes a threat of meningeal infection, and those in which the infection has broken outward and formed a fistulous tract toward the middle ear spaces. There are a number of reports which show tracts that broke outward into the soft tissues of the neck and eventually were evacuated in this unusual way. I have seen two cases of this type.

Aloin [73] reports three cases, in one of which the pus followed the styloid process and appeared in the muscles of the lateral pharyngeal wall. Antognoli [74] reports a case of tuberculous osteitis of the petrous tip which finally led to an abscess in the neck. After evacuation, a local cure occurred. In Seydell's [60] second case a pharyngeal abscess developed.

As an example of cases of fistulas into the pyramid, the case reported by Piquet [58] is interesting. A woman 59 years of age in the course of a suppuration of the right middle ear had pain in the right parietal region and mastoid antrum. Otherwise the mastoid was not tender to pressure. Heavy shadows were shown on the roentgen film

71. Fioretti, Ferruccio: Il dolore oculare in un caso di otite cronica colesteatomatosa riacutizzata, Riv. oto-neuro-oftal. **10**:583, 1933.

72. Kopetzky, Samuel J.: Problems Concerned with Anatomy, Pathology and Surgical Treatment of Suppuration of Petrosal Pyramid, Arch. Otolaryng. **19**: 143 (Jan.) 1934.

73. Aloin, Henri: A propos des ostéites profondes de la pointe du rocher, Ann. d'oto-laryng., 1933, no. 2, p. 194.

74. Antognoli, G. C.: Fistola latero-cervicale da osteite della base cranica in individuo affetto da mastoidite specifica, Valsalva **9**:834, 1933.

of the deep-lying cells, while the cells of the mastoid process were generally clear. After fourteen days the haziness was less marked. Meanwhile the pain continued, and seven weeks later it increased and was accompanied by swelling over the mastoid process. On mastoidectomy, which revealed a coalescence most marked in the cells of the mastoid tip, there was discovered a short distance upward from the tip a fistulous tract which led into the depths of the petrosal pyramid. The patient was cured.

Moulonguet and Pierre [65] report operation in a case in which they found a fistula leading from the labyrinth into the tip of the pyramid. They opened the labyrinth because indications for labyrinthectomy were present. The patient recovered slowly, requiring thirteen months of convalescence. There remained a permanent facial paralysis. Seydell's first case showed a purulent tract leading toward the knee of the internal carotid artery.

There are many cases in which the empyema within the pyramid ruptures intracranially; and when the seepage is slow there develops an extradural abscess located over the petrosal pyramid. Cases of this type are reported, among others, by Lemaitre and Lemoine,[59] Ballenger [57] and Bernstein.[62] Ruttin [64] found an extradural collection of pus at the internal auditory meatus. His report is instructive in that it demonstrates the resourcefulness of a surgeon who, convinced that he was faced with a purulent lesion within the pyramid and unable to reach the lesion by one route, resorted eventually to the translabyrinthine route to remove the lesion and save the patient's life. The cure, however, was effected at the sacrifice of the labyrinth.

A number of cases are reported which terminated in meningitis and death. The subject is still too new and too little comprehended generally to warrant a critique of the cases reported and the procedures undertaken to produce cure. For the present, let it suffice to note some of them. The reports of Ballenger,[57] Blassingame,[61] Cavanaugh,[75] Lawson [76] and others will furnish instructive reading.

The case reports of cures likewise cannot be examined too closely. In many of them, a question of the established diagnosis arises. In our report of cases of cured empyema of the petrous apex (Kopetzky and Almour [66]), the finding of encapsulated pus within the pyramid, the postoperative relief of significant symptoms and the injection of iodized poppy-seed oil proved the diagnosis, as far as it is possible to prove a lesion to have existed in a living person.

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75. Cavanaugh, I. A., in discussion on Ballenger, Howard: Petrositis, Arch. Otolaryng. **17**:728 (May) 1933.

76. Lawson, Lawrence J.: The Problem of Meningeal Infection from Petrositis: Report of Cases, Arch. Otolaryng. **17**:640 (May) 1933.

Galtung [77] reports a cure obtained by the use of the Frenckner technic; and Frenckner [78] himself reports a cure without injuring the labyrinth.

At a meeting of the American Laryngological, Rhinological and Otological Society [79] I discussed, compared and analyzed the surgical procedures advocated by Eagleton, Voss, Frenckner and Ramadier. It was my purpose to show that no one procedure was applicable to all types of cases. I gave, finally, the reasons why I advocate the Almour technic for encapsulated empyema in a pneumatized petrosal pyramid. When all these procedures are better understood, the advantages of this procedure, which in my hands and those of Almour has been so successful (among 31 cases we have had 26 cures), will, I feel sure, meet with a more general acceptance.

I cannot close this article without a passing comment on a very pretentious article by Ruskin.[56] Ruskin has two objectives in writing his article: (1) to prove that the earliest sign of involvement of the petrous bone is a disturbance of circulation in the venous network of the bone, and (2) to prove that there are two outstanding syndromes, (*a*) that described by Gradenigo, with involvement of the abducens nerve and orbital pain, and (*b*) that suggested by Ruskin, characterized by edema of the lower lid on the same side, temporomaxillary orbital pain and trismus.

The author gives a textbook description of the venous network and other anatomic data but fails to advance one proof of scientific value to substantiate the so-called syndrome that he suggests. To support his argument he cites a case of mine in which, among other symptoms, I noted edema of the lid on the affected side, but he evidently overlooked the fact that this patient intercurrently went through the symptoms of sinus thrombosis for which she was operated on. Eventually suppuration in the petrosal pyramid developed and was diagnosed, operated for and cured.

I have to date observed 31 cases in detail and never found the alleged syndrome of Ruskin present. In my opinion, none of his cases would pass critical analysis as cases of suppuration of the petrous pyramid.

Edema of the eyelid is truly often a symptom of venous stasis. Among other lesions, it has been observed in connection with sinus thrombosis and zygomatic otitis.

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77. Galtung, A.: Some Remarks on the Treatment of Apicitis (Petrositis) in General and on Frenckner's Operation in Particular, Acta oto-laryng. **18**:487, 1933.

78. Frenckner, P.: Apicitis—Operated on Without Injury to the Labyrinth, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **22**:124 (Feb.) 1934.

79. Kopetzky, Samuel J.: Problems Concerned with Empyema of the Petrous Apex, Arch. Otolaryng. **18**:47 (July) 1933.

To recommend paracentesis as a preventive for petrositis fails to take into account the fact that with the onset of the petrosal lesion a recurrence of the otorrhea is generally reported. I have seen it in all of my cases. Moreover, in some cases the discharge from the middle ear does not stop after the original mastoidectomy.

I cannot question the author's observations. His 3 patients all presented edema of the lid and were cured by paracentesis. I may, however, question his conclusions. I can hardly accept his cases reported as being instances of petrosal suppuration.

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Clinical Notes

PRIMARY JUGULAR BULB THROMBOSIS IN AN ADULT

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Primary jugular bulb thrombosis is not an infrequent occurrence in infants and children. Since McKernon[1] first called attention to this condition, a little more than a quarter of a century ago, a number of cases have been described. In adults primary jugular bulb thrombosis is extremely rare, relatively few cases having been reported. In the instances cited the age range was well within the third decade of life. The patients of Potts,[2] Ginsberg,[3] and Maybaum and Goldman[4] were all under 21 years of age. The patient of Wieder and Bates[5] was 26 years old. Fraser's[6] patient was a 41 year old woman and her case, except for the one presented here, is the only example, to my knowledge, of primary bulb thrombosis in a middle aged person.

REPORT OF A CASE

History.—P. W., a white man, aged 46, had pain in the left ear following an attack of grip. Two days later spontaneous rupture of the left drum head occurred with mucoserous discharge. During the next week the patient complained of excruciating earache and left-sided headache. Examination of the ear disclosed a slightly bulging tympanic membrane. The temperature was 98.2 F.; the pulse rate, 80. There were no sagging of the posterior superior canal wall and no tenderness over the mastoid. Because the clinical evidence did not warrant the intensity of his suffering he was sent to the Graduate Hospital of the University of Pennsylvania for observation and study.

On admission the patient did not appear critically ill. His color was good. The tongue was moist and only slightly coated. On account of the slight elevation in the pulse rate and the normal temperature the impression was gained

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1. McKernon, J. F.: Primary Bulb Thrombosis in Children as a Complication of Acute Purulent Otitis Media with Report of Cases, New York M. J. **82**:4 and 57, 1905.

2. Potts: Primary Thrombosis of the Jugular Bulb, Internat. Clin. **3**:280, 1906.

3. Ginsberg, W.: Two Cases of Primary Jugular Bulb Thrombosis Not in Infants, Laryngoscope **35**:800 (Oct.) 1925.

4. Maybaum, Jacob L., and Goldman, Joseph L.: Primary Jugular Bulb Thrombosis; A Study of Twenty Cases, Arch. Otolaryng. **17**:70 (Jan.) 1933.

5. Wieder, Henry S., and Bates, W.: Primary Jugular Bulb Thrombosis with Numerous Metastatic Infections: Operation; Recovery, Laryngoscope **37**: 48 (Jan.) 1927.

6. Fraser, J. S.: Case of Septic (Otitic) Thrombosis of the Internal Jugular Vein: Operation; Recovery, Edinburgh M. J. **5**:60, 1910.

that he might be a neurotic person who was magnifying his complaints. The examination of the blood, however, revealed a count of 15,000 leukocytes with 80 per cent polymorphonuclears. The roentgenographic findings showed a slight clouding of the mastoid cells but no breaking down of the intracellular structure. For two days following admission the severe earache and headache continued, the temperature and the pulse remaining unchanged. On the evening of the second day, January 7, a chill developed and lasted fully twenty minutes; following this the temperature rose to 105 F. Although there was no tenderness over the mastoid, tenderness could be elicited along the anterior border of the sternocleidomastoid muscle near its insertion. A mastoidectomy was decided on and immediately performed.

Operation.—The mastoid process was found to be moderate in size and of fair pneumatization. Removal of the mastoid cortex disclosed a slight congestion of the mastoid cells but no other pathologic changes. The lateral sinus, which was in a median posterior position, was uncovered, revealing a sinus wall normal in all respects. In an attempt to find a cause for the unusually high temperature the middle fossa was also exposed, but the dura appeared normal. The culture from the mastoid wound showed no growth.

For the next twelve days the temperature varied from 99 to 102 F. Pregl's solution (the solution resulting from the action of iodine on sodium carbonate solution) was given intravenously daily in doses of 20 cc. The earache and the headache, while not as severe as formerly, came on at intervals. On January 19 a second chill more severe and of longer duration than the one prior to operation developed, the temperature rising to 105.3 F. Blood cultures made on five different occasions, even during the period of chill and high fever were always negative. The blood count showed an average of 16,000 leukocytes with from 80 to 85 per cent polymorphonuclears. Repeated thorough examinations by the internist failed to reveal evidence of pneumonia, endocarditis, malaria or other conditions that could account for the symptoms. The picture resembled that of an infection of the blood stream. An Ayer-Tobey test was suggested at this time, but the patient refused to have a lumbar puncture performed. On January 21 a blood transfusion was given. The next day the patient experienced pain on moving his left shoulder, and a slight swelling developed over the shoulder bursa. This was incised by Dr. William Bates and revealed a greenish fluid which was sterile on culture. Twenty-four hours later there was another severe chill with a rise in temperature to 105.3 F. Notwithstanding the repeatedly negative blood cultures, radical measures were deemed advisable.

Jugular Ligation.—On January 23, sixteen days after the mastoidectomy the mastoid wound was reopened and the sinus plate uncovered more extensively. Despite a normal-appearing sinus wall the lateral sinus was plugged above and below and then incised. A profuse welling up of pus and thrombi appeared from the direction of the jugular bulb. The torcular end of the lateral sinus bled rather freely. The left internal jugular vein was then ligated. Culture of the pus from the sinus showed hemolytic streptococci. A strip of gauze containing iodoform was inserted in the lumen of the lower end of the sigmoid sinus to drain the bulb, and the mastoid wound was loosely packed. Following the jugular ligation there was definite improvement for twenty-four hours, after which the temperature again rose to 105 F., but was unaccompanied by a chill. Withdrawal of the strip of gauze from the lumen of the sinus indicated that instead of acting as a drain the gauze had dammed back the pus, and this accounted for the high fever. After removal of the gauze there was no further rise in tem-

perature. A gradual general improvement was noted, and the blood picture showed a return to normal. The patient, however, still complained of a left-sided headache. To rule out an intracranial complication, an ophthalmic examination was made, but there was no blurring of the disks or limitation of the visual fields. On the theory that a disturbance of circulation with an increase in intracranial pressure, a sequel to the jugular ligation, might be responsible for this discomfort a lumbar puncture was advised, and the patient now readily consented. The spinal fluid came out at a pressure registering 20 mm. of mercury; it was perfectly clear and had a cytologic count of 5 cells per cubic centimeter. With the needle in the spinal canal and the left jugular vein already ligated an opportunity was afforded to check the accuracy of the Ayer-Tobey test for determining a block in one of the internal jugular veins. Accordingly, pressure was made over the right—or normal— jugular vein. An increase of spinal pressure to 35 mm. resulted. Pressure over the left or ligated vein caused no change in the spinal pressure, which remained at 20 mm. This demonstration was convincing and corroborated the value of the test. After the spinal puncture and a withdrawal of several cubic centimeters of spinal fluid the headache lessened considerably. Two weeks later the patient was discharged from the hospital cured.

This case is classified as one of primary jugular bulb thrombosis because of the absence of pathologic changes in the mastoid cells, the normal appearance of the sinus wall when the sinus plate was uncovered, and the presence of infected thrombi in the jugular bulb.

1305 Spruce Street.

METHOD FOR REMOVAL OF AN OPEN SAFETY-PIN, POINT UP, FROM THE BRONCHUS

C. P. Schenck, M.D., Fort Worth, Texas

Generally the removal of an open safety-pin involves the use of well known principles. Occasionally the problem must be solved by a new application or combination of these principles. I believe that the following report of a case illustrates a method not heretofore described.

REPORT OF A CASE

A girl aged 10 years inhaled a ¾ inch (1.91 cm.) open safety-pin at about 1 p. m. on Dec. 27, 1933. A roentgenogram taken immediately showed it to be located point upward and inward at the level of the fourth dorsal vertebra. With this picture as a guide, an unsuccessful attempt was made the next morning to remove the pin with the aid of a 7 mm. bronchoscope. The impression was gained that the pin was deeper than was shown by the roentgenogram and that the point was upward and outward, although the head of the pin was the only portion actually identified. Another roentgenogram showed the point of the pin upward and outward opposite the seventh dorsal vertebra. Because it was believed that the point was embedded or might become so, or that it might be caught in the bronchus of the upper lobe, a combination of the methods described by Jackson[1]

1. Jackson, Chevalier: Bronchoscopy and Esophagoscopy, ed. 2, Philadelphia, W. B. Saunders Company, 1927, p. 250.

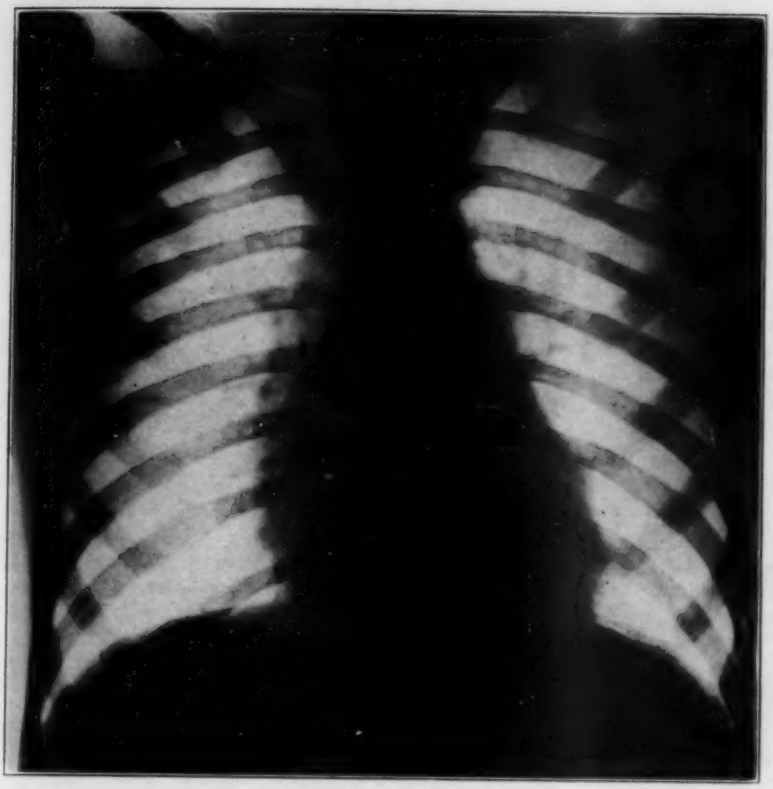

Fig. 1.—The ¾ inch, open safety-pin, point up, is seen in the right bronchus at the level of the seventh dorsal vertebra.

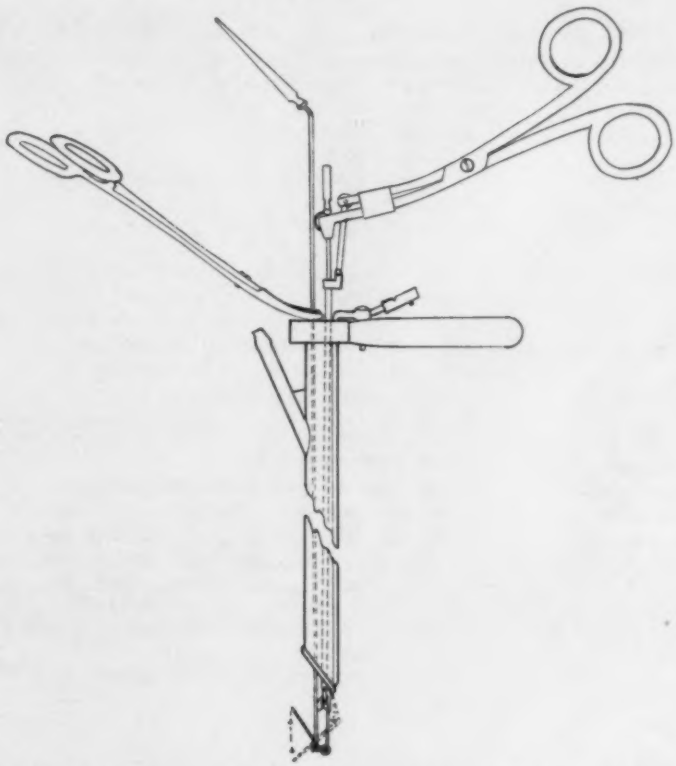

Fig. 2.—Rotation forceps locked in the keeper of the pin and the prong astride the pointed shaft near the spring; the shaft of the prong is fixed by forceps at the mouth of the tube; the point trails and straightens as the result of traction on the keeper.

as "dangling" and "straightening" was worked out with the practice board and tubes. The accompanying illustration and the following description should make this clear.

Because the 9 mm. bronchoscope gives approximately 40 per cent more working space than the 7 mm. size, the former was used. The tip of the bronchoscope could not reach the pin, but it was brought as near as possible to it. Through the tube of this size the keeper and spring of the pin could be recognized. The rotation forceps was clamped through the hole in the keeper, and the handles were locked together with a strip of adhesive tape. A "safety-pin prong" was then placed astride the pointed shaft of the pin and tape carried down to the spring. The prong was fixed in this position by an artery forceps clamped on its shaft at the mouth of the bronchoscope. With the left hand holding the artery forceps, the prong and the bronchoscope rigidly together as a unit, the right hand made firm traction on the rotation forceps. The prong acting as a fulcrum caused the point to trail and straighten out to an angle of about 150 degrees, in which condition the pin was readily drawn into the bronchoscope.

Four days after the accident this method was used on the patient, and removal of the pin was accomplished without injury. The temperature did not reach 100 F. and promptly subsided to normal, and the child has remained well to date.

Chevalier Jackson straightens a safety-pin by grasping the keeper as described and then sliding the bronchoscope down until the lip engages the pointed shaft at the spring, when traction is made against the lip as a fulcrum.

In my method the larger tube can be used with obvious advantages, and the fulcrum can be advanced to a position which the tip of the tube cannot reach because of its large diameter.

Abstracts from Current Literature

Ear

THE BONY CAPSULE OF THE MIDDLE EAR IN RODENTS (RABBIT, GUINEA-PIG, MOUSE AND RAT). K. HAFNER, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **137**:282 (Dec. 20) 1933.

Hafner made a comparative embryologic and anatomic study of the bony components of the middle ear in the rabbit, guinea-pig, mouse and rat. His primary purpose was to determine which animals were suitable by comparable development and anatomy for use in experimental work, especially on otosclerosis. On the basis of his studies he concludes that rabbits and guinea-pigs have bony labyrinthine capsules which in development and structure, even fibrillar structure, are similar to that of man in every particular. These animals, he believes, are especially suitable for experimental work. Mice and rats, on the other hand, possess bony middle ear capsules which differ in several respects from that of man.

EDITOR'S ABSTRACT.

HOW DOES A GENUINE CHOLESTEATOMA ARISE? K. WITTMAACK, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **137**:306 (Dec. 20) 1933.

Wittmaack believes that true cholesteatoma is essentially different from that arising secondarily from chronic infection. He thinks that constitutional factors play a part, namely, a compact sclerotic mastoid process and a hyperplastic mucous membrane. The site of origin of true cholesteatoma is the pavement epithelium which covers the pars flaccida of the tympanic membrane. The action of physical factors on these underlying constitutional susceptibilities seems to offer the necessary stimulus for cholesteatoma formation. Differentiation from secondary cholesteatoma is difficult and often cannot be made except at necropsy. Primary cholesteatoma should nevertheless be considered, since it is more dangerous than the secondary type and, in the author's opinion, should be treated by radical operation.

EDITOR'S ABSTRACT.

MUCOUS OTITIS. H. ROLLIN, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **137**:333 (Dec. 20) 1933.

Rollin believes that the demonstration of the cause of mucous otitis is essential to the diagnosis. Because of the similarity in cultural characteristics of Streptococcus mucosus and related strains of pneumococci, he feels that a direct smear should be made as well as a culture. When stained with thionine the smear shows a wide light red halo around Str. mucosus while Str. lanceolatus, which is otherwise similar, shows no capsule. In contrast to otitis due to a hemolytic streptococcus, which usually begins with a rapid inflammatory onset and a reddened tympanic membrane, mucous otitis is often insidious in onset and presents a pale tympanic membrane and a profuse mucopurulent discharge. The author describes eight fatal cases of mucous otitis with necropsy in six. These six cases had in common a surprising course, in that apparently harmless mucous otitis developed into rapidly fatal meningitis. Anatomically they all had the same focus in the upper part of the pyramidal tract, namely, a cell complex which is made air-containing from the epitympanum. There was no direct connection, however, between these air-containing cells and the antrum. Rollin believes that from this focus a subdural abscess sometimes develops, after which the special anatomic characteristics of the original focus disappear, so that a clear understanding of the origin of the abscess is no longer possible.

EDITOR'S ABSTRACT.

CHANGES IN THE MACULA AFTER DETACHMENT OF THE OTOLITHIC MEMBRANE. C. F. WERNER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **33**:593 (Oct. 14) 1933.

Werner states that the modification of the static reflexes of guinea-pigs after rotation (centrifugation) is caused not only by detachment of the otolithic membrane but probably also by an injury of the sensory epithelium. The sensory cells, especially their nuclei, are altered, while the supporting cells merely undergo a secondary displacement through intracellular vacuoles. The sensory hairs collapse and later straighten up again or are replaced by new ones. In the course of months, the macula regenerates, but the otolithic layer does not. The pathologic changes and the manifestations of regeneration suggest a genetic relation between the hair processes and the otolithic membrane. EDITOR'S ABSTRACT.

PATHOLOGIC CHANGES IN OTOGENOUS PARAPHARYNGEAL ABSCESS: REPORT OF A CASE. G. KELEMEN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **33**:600 (Oct. 14) 1933.

Kelemen reports a case of bilateral otitis media in which the process healed spontaneously on one side, while on the other there was a recurrence complicated by a parapharyngeal abscess. The development of the abscess can be divided into three phases. In the first phase, the pus remained in the vicinity of the external auditory meatus. In the second phase, the suppuration spread toward the posterior pharyngeal wall, and in the third phase, it spread along the sternocleidomastoid muscle, where it was incised after the mastoid was opened. The operation disclosed only minimal pathologic changes. The path of the abscess could not be exposed, but it was reconstructed on the basis of clinical symptoms.

EDITOR'S ABSTRACT.

PRESCRIPTION OF APPARATUS FOR THE AID OF HEARING AND THEIR MODE OF ACTION. E. WIRTH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:43 (Nov. 10) 1933.

Wirth made comparative tests with speech sounds and other tones (by means of the oto-audion) which showed that in hearing with an electric hearing apparatus, the auditory threshold for the device and the understanding of speech are about equivalent. When the auditory threshold is significantly raised by the use of an electric hearing apparatus, one may conscientiously recommend the purchase of such a device. Ear trumpets sometimes achieve better results than electric hearing apparatus. The electric apparatus now in use are all constructed on the same principle (microphone-battery-telephone), and there is little difference in the action of different types. Persons with slight baryecoia derive little benefit from them because of their physical defects. Disturbances of conduction are frequently favorably influenced by ear trumpets and especially by electric hearing apparatus. Labyrinthine deafness exhibits a variable response. Electric hearing apparatus usually fail in presbyacusis and in syphilitic baryecoia. Probably only those forms of labyrinthine baryecoia which result from decreased sensitivity of the peripheral cochlear apparatus can be much improved by such devices. In severe labyrinthine baryecoia the hearing curves obtained with the oto-audion exhibit a more or less pronounced concentric restriction of the range of hearing and a decreased sensitivity for all tones. For the correction of labyrinthine baryecoia it appears, according to the hearing curves, that just as in middle ear deafness, an equal increase in the intensity of all tones is the most efficacious. Electric hearing devices suffice for this to a certain degree and frequently cause a considerable elevation of the auditory threshold and a widening of the range of hearing. Accessory sounds disturb the hearing with an electric apparatus more in labyrinthine deafness than in conduction deafness. The prescription of electric hearing apparatus should be done by an otologist. EDITOR'S ABSTRACT.

ACTINOMYCOSIS OF THE TEMPORAL BONE. H. BARTH, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:376, 1933.

Barth describes the histologic changes in a case of actinomycosis of the temporal bone. The process probably spread to the temporal bone and the middle ear from the underlying surface of the pyramid. At the same time thrombosis of the bulbus venae jugularis and of the sigmoid sinus led to fatal meningitis.

EDITOR'S ABSTRACT.

HISTOLOGIC OBSERVATIONS ON ARTIFICIAL INTRA-UTERINE INJURY TO THE ORGANS OF HEARING. O. VOSS, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:381, 1933.

Voss reports a case of intra-uterine injury to the organs of hearing in which the child was born dead. The mother was an elderly primipara. The major features of the obstetric history were: ruptured fetal membranes, coccygeal presentation, poor heart tones and manual delivery. Deep hemorrhages and torn tympanic membranes were found in the organs of hearing. These must be explained on the basis of injury sustained at birth, the manipulation at the time of delivery or criminal abortion. Because of the nature and depth of the injuries to the ear, it is felt that the true cause was attempted criminal abortion with a sharp instrument, occurring not long before birth.

EDITOR'S ABSTRACT.

ROENTGENOLOGIC CHANGES IN THE TEMPORAL BONE IN SCHÜLLER-CHRISTIAN DISEASE: REPORT OF TWO CASES. A. GREIFENSTEIN, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:384, 1933.

The symptomatic triad of defects in the membranous bones, diabetes insipidus and exophthalmos may not all be present in xanthomatosis. Greifenstein describes two cases in which sharply circumscribed rarefactions of the squamous part of the temporal bone as well as of the mastoid process occurred. Following roentgen treatment, the rarefactions disappeared. The author felt that a rise in blood cholesterol which occurred later confirmed the diagnosis. A normal tympanic membrane, cochlear dysfunction and roentgen changes in the mastoid process or in the temporal bone make it desirable to look for further symptoms of Schüller-Christian disease.

EDITOR'S ABSTRACT.

PSORIASIS OF THE TYMPANIC MEMBRANE. H. LEICHER, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:393, 1933.

Leicher describes three cases of psoriasis of the tympanic membrane, with perforation in two, which resulted from an injury caused by caustics or by radioactive salves. Treatment is slow and difficult, and there is a great tendency toward relapse, as in psoriasis of other parts of the body.

EDITOR'S ABSTRACT.

CUTANEOUS HORN OF THE AURICLE. C. VON EICKEN, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:396, 1933.

Von Eicken describes a verrucous-like cutaneous horn which originated on the posterior wall of the auricle at the margin of the external auditory meatus in a man, aged 64.

EDITOR'S ABSTRACT.

Pharynx

SURGICAL TREATMENT OF TONSILS IN CHILDHOOD. M. NADOLECZNY, München. med. Wchnschr. **80**:1124 (July 21) 1933.

This is a long article concerning many indications and contraindications for tonsillectomy. Simple enlargement of the tonsils requires tonsillectomy only when there are respiratory disturbances and changes in the voice. Suppurative infections of the tonsils are frequent in childhood and are usually harmless. These may

occur between two and three times a year but are not an indication for tonsillectomy. If the infection becomes chronic, the tonsils should be removed. Peritonsillar abscess is not always an indication for surgical intervention. Acute septic infections require immediate tonsillectomy. In chronic septic infections the value of tonsillectomy is questionable. In acute articular rheumatism preceded by angina, tonsillectomy is often beneficial, although recurrences may occur following pharyngitis. In muscular rheumatism, neuralgia and neuritis the effect is questionable. Acute glomerular nephritis, embolic focal nephritis (without nephrosclerosis), polyarthritic endocarditis, glandular fever and conditions found in carriers of diphtheria bacilli are frequently improved after tonsillectomy. In chorea, chronic nephritis, severe endocarditis and myocarditis the operation has no effect. Removal of the tonsils does not protect against diphtheria or Vincent's angina. Nadoleczny advises careful examination with rhinoscopy of all patients. He prefers tonsillectomy to tonsillotomy. An unnecessary operation is detrimental to the patient, the physician and the medical profession, because it destroys the confidence of the patient.

BRAHDY, Mount Vernon, N. Y. [AM. J. DIS. CHILD.]

Larynx

ORIGIN OF LARYNGEAL FIXATION BY CARCINOMA OF THE LARYNX. S. ZOLTÁN, Monatschr. f. Ohrenh. **68**:319 (March) 1934.

Zoltán examined seven larynxes from the museum collection of his clinic. These were removed because of carcinoma. Serial sections were made and examined histologically. The clinical history and physical observation were known in each instance. The changes in the arytenoid cartilage were especially noticed. In every larynx from a patient who had shown clinical evidence of decreased motility, there were changes in the arytenoid cartilaginous joint. One of these larynxes was especially interesting. The tumor extended to the anterior third of the right vocal cord, and a definite thickening of the perichondrium existed in spite of the fact that no carcinomatous infiltration could be found in the neighborhood of the cartilage. Clinically, this larynx had been fixed. The changes in the perichondrium varied from simple thickening to actual cartilage destruction. It was not always possible to differentiate between fixation of the involved musculature and the processes of the perichondrium previously described. It is certain, however, that these processes affect the motility of the arytenoid cartilage. Perichondritis is certainly the resultant of atypical cell proliferation. The author concludes that this factor also plays an important rôle in fixation of the carcinomatous larynx.

EDITOR'S ABSTRACT.

AUSCULTATION OF RESPIRATION IN THE LARYNX. E. FRÖSCHELS, Monatschr. f. Ohrenh. **68**:385 (April) 1934.

Fröschels describes a simple method for diagnosing unilateral paralysis of a vocal cord by auscultation. This is especially useful when laryngoscopy is impossible. It is based on the principle that in inspiration the nonparalyzed cord is farther from the midline than the paralyzed cord and hence allows more air to pass on that side with a difference in sound produced on the two sides. If the paralyzed cord is fixed medially or paramedially this difference will also occur with expiration. In order to demonstrate the phenomenon the author placed the small part of a hearing tube in the end of an ear trumpet and the wide end over the ala of the thyroid cartilage. After listening to several respirations, he repeated this on the other side. The method was later modified by making a simple double hearing tube from a Y-shaped glass tube and three cannulas, one of which led to the ear and the other two to two small glass bells which were placed on the two alae of the thyroid cartilage. By pressing first on one bell and then on the other, the differences in respiratory sound could be still better noted. Twelve observations with this simple technic are reported. It is easy and satisfactory with a little practice.

EDITOR'S ABSTRACT.

TREATMENT OF LARYNGEAL TUBERCULOSIS BY ARTIFICIAL SUNLIGHT (WESSELY LAMP). J. SPIRA, Monatschr. f. Ohrenh. **68**:405 (April) 1934.

Spira treated his patients with laryngeal tuberculosis by indirect irradiation with the help of Wessely's special steel mirror. In about 15 per cent of the patients treatment was not completed, usually because of unfavorable formation of the roof of the larynx. Eighty-four patients came to treatment, but only forty-four received an adequate series of irradiations. The number of treatments for the individual patients varied between forty and one hundred. Patients presenting progressive pulmonary processes, fever, an increased sedimentation rate of the blood and, especially, lack of energy were in general not subjected to this treatment. Of thirteen patients with infiltration of the vocal cords or posterior wall of the larynx, two were cured, five were improved, and the condition of six was unchanged. Of sixteen patients having infiltration and ulceration of the posterior wall, two were cured, seven were improved, the condition of five was unchanged and two became worse. Of fifteen patients with infiltration and deep, wide ulcerations one was cured, three were improved, the condition of seven was unchanged and four became worse. Finally, the author treated seven patients by this method who complained of painful swallowing with progressive pulmonary and laryngeal tuberculosis. In five of these the pain disappeared entirely or was much reduced, and in two it remained the same. Thus about 11 per cent of these patients were cured, 34 per cent were improved, 41 per cent were not affected and 14 per cent became worse. The author concludes that in selected cases of laryngeal tuberculosis this is a favorable method of treatment. The best results are obtained in cases of limited infiltration, while those of extensive infiltration are resistant. Patients presenting progressive pulmonary processes should not be treated in this way even if the process is not active. In cases of dysphagia relief is often obtained.

EDITOR'S ABSTRACT.

MEASUREMENTS OF SUBGLOTTIC PRESSURE IN CANNULA CARRIERS. W. BERGER, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folio oto-laryng.) **25**:28, 1934.

In three patients on whom tracheotomy had been performed Berger measured the subglottic pressure under various conditions. The intratracheal cannula was attached to a T-shaped tube, one branch of which led to the manometer and the other to the writing point of the smoked drum. A water manometer was used except during pressure on the larynx or during coughing, at which time the pressure rose so high that a mercury manometer was necessary. In the first two patients the condition of the larynx approached normal; in the third patient cicatricial laryngeal stenosis was present. When the patients said the vowels a, o, u and e, slight increases in pressure occurred. When these vowels were whispered, the increase was much less. Pressure and coughing increased the subglottic pressure markedly. The author states, however, that from the small number of patients examined no conclusions can be drawn as to the particular details of the function of the laryngeal muscles. A vocal range of less than two octaves must be of limited value. By the dynamometric method of observation, in which a rubber cylinder is introduced into the glottis, the sum of different forces (adduction force plus subglottic pressure) is measured. Dissociation analysis of these physical components is not, however, possible.

EDITOR'S ABSTRACT.

Nose

VOLUMINOUS ORBITO-CRANIAL OSTEOMA. CONSECUTIVE CEREBRAL ABSCESS OF NASAL ORIGIN. J. N. ROY, Brit. J. Ophth. **18**:159 (March) 1934.

The patient was an unmarried woman, aged 24 years, from whom on May 8, 1925, Roy removed an osteoma of the orbit weighing 28 Gm. She had good health until October 1931, when to the accompaniment of a sensation of fulness in the right orbital cavity without pain the eye slowly proptosed. A growth could be

felt by luxating the globe slightly downward. A frontal roentgenogram showed complete opacity of the right orbit. The corresponding frontal sinus was normal. The profile "showed a nippled bony tumor, more voluminous than a large nut, localized forward in the posterior part of the orbit and in the rear of the cranial cavity." There were fever, headache and vomiting. In each eye vision equalled 20/30 (6/9). During the removal of the osteoma, which had its origin in the ethmoid sinus, 20 cc. of pus flowed from the frontal lobe. The patient died twenty-eight hours after the operation from leptomeningitis.

The postmortem examination showed an absence of the roof of the orbit. The growth had developed on the old cicatricial tissue of the orbit as a fibroma which in the process of time had progressively undergone ossification. It is assumed that the microbes coming from the nose had proceeded to the brain by the cortical part of the osteoma. The article is illustrated.

W. ZENTMAYER. [ARCH. OPHTH.]

OPTIC NEURITIS ORIGINATING FROM SINUSITIS. Q. DI MARZIO and G. FERRERI, Ann. d'ocul. **170**:692 (Aug.) 1933.

Di Marzio and Ferreri studied the relation of optic neuritis, both edematous and retrobulbar, to disease of the nasal accessory sinuses, either confirmed or latent sinusitis. They studied and operated on thirty patients with various lesions of the optic nerve accompanied by a considerable decrease of visual acuity. Opening of the ethmoid or sphenoid sinuses resulted in improvement of most patients, but the highest percentage of improvement was obtained when there was no evidence of sinusitis clinically, roentgenographically or at operation; next in importance is the percentage of improvement in forms of confirmed or latent sinusitis. Improvement or cure was noted as early as twenty-four hours after intervention. In other cases improvement occurred after several months or years. Patients showing improvement passed through several stages, from absolute central scotoma to relative scotoma and then to disappearance of the scotoma. The report is presented with numerous roentgenograms and charts of the visual fields.

BERENS, New York. [ARCH. NEUROL. & PSYCHIAT.]

FOLDING OF THE RETINA FROM AN EXUBERANT FRONTAL MUCOCELE. D. MICHAIL, Ann. d'ocul. **171**:126 (April) 1934.

Folding of the retina from orbital causes has been reported very seldom, and knowledge of it has not as yet become of practical value. Little clinical knowledge has been obtained of the appearance of the lesion or of its pathologic mechanism. For this reason it was thought wise to report in detail a case in which folding of the retina was caused by a mucocele of the frontal sinus.

The patient, 56 years of age, had complained at intervals for six years of pain in the left frontal sinus accompanied by corresponding progressive exophthalmos, which with other ocular troubles obliged her to consult an ophthalmologist. The clinical study, the roentgenogram and the operation showed the existence of an exuberant mucocele of the left frontal sinus, which after having completely destroyed the floor of the sinus progressed into the orbit. The orbital invasion caused an exophthalmos of 8 mm. and vertical compression of the ocular globe, shown by hyperopic astigmatism of 1.5 diopters and by about twenty horizontal parallel retinal folds situated on the temporal side of the disk. This was accompanied by peripapillary edema and perivascular retinitis.

The article has four illustrations, that of the retinal folds demonstrating the clinical condition very well.

S. H. MCKEE. [ARCH. OPHTH.]

TWO UNUSUAL CASES OF FRONTAL SINUSITIS WITH DILATATION AND EXPOSURE OF THE DURA IN THE ROOF OF THE FRONTAL SINUS. C. VON EICKEN, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folio oto-laryng.) **25**:14, 1934.

Von Eicken describes two cases with somewhat similar and unusual involvements of the frontal sinus. The first case was that of a man, aged 58, who had

had trouble for several years and had had two operations. A radical operation on the frontal sinus was performed, at which time most of the sinus mucosa above the supra-orbital arch was present and formed a deep recess in the orbital roof which was bounded by the dura above and behind and by the periosteum of the orbital ring on the ocular side. Bone formation was thus absent in the depth of the floor of the orbit. The mucosa was carefully dissected away from the dura and orbital ring. No communication could be found between the cyst and the nose. The frontal process of the maxilla, part of the lacrimal bone and the lamina papyracea of the ethmoid, so far as present, were abundantly removed to make a wide connection of the field of operation with the nose. The other case was that of a man, aged 63; the operative results were similar. The author believes that resorption of bone in this neighborhood is unusual.

EDITOR'S ABSTRACT.

HYPERNEPHROMA IN THE REGION OF THE ETHMOID. C. VON EICKEN, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folio oto-laryng.) **25**:52, 1934.

Von Eicken describes the case of a man, aged 68, with a large pulsating tumor extending from the internal canthus to the frontal region. This tumor was removed under local anesthesia with great difficulty because of hemorrhage. Histologic examination revealed it to be a hypernephroma. The condition recurred, reaching almost the same size. Treatment with radium and roentgen rays caused it to regress slowly until only a deep scar remained. The primary hypernephroma around the kidney could not be positively determined, but operative intervention on this would not have been possible because of the patient's general condition.

EDITOR'S ABSTRACT.

Miscellaneous

CLINICAL LIGHT ON CARCINOMA OF THE ESOPHAGUS. V. SANGIOVANNI, Arch. ital. di otol. **46**:1 (Jan.) 1934.

Sangiovanni studied eighteen patients presenting carcinoma of the esophagus, two of whom evinced vomiting, hematemesis, anorexia, anachlorhydria, a feeling of weight in the epigastrium and severe pains. The author attributes the gastric symptoms to the absence or late appearance of dysphagia and to gastric disturbances. Such a disturbance as hyperchlorhydria or achlorhydria may result from cachexia, general anemia or the swallowing of septic products. Esophagoscopy and gastroscopy aided the diagnosis in cases in which repeated roentgen examinations gave dubious or no results. Carcinoma of the esophagus with mediastinal symptoms is rare. It is manifested by symptoms of pressure on the large veins and the nerve trunks. Two of the author's patients presented such symptoms. Dysphagia is the predominating symptom. It may appear in the early stage of the disease but is generally observed after a period of anemia. It becomes manifest after ingestion of solid foods and of hot or irritating liquids. Psychic factors seldom influence dysphagia. A frequent complication of esophageal carcinoma is the formation of a fistulous passage in the trachea and the bronchi. Of the eighteen patients, seven showed perforations in the respiratory tract, four in the trachea, two in the left bronchus and one in the right bronchus. The duration of esophageal carcinoma varies from a few months to two years, depending on the histologic form of the tumor. The ulcerative vegetative forms progress rapidly, whereas the cirrhotic forms develop gradually and generally without metastases. The metastases, secondary infections and fistulas in various limitrophic organs lead to a rapid decline in the condition of the patient. The prognosis is generally fatal. The author recommends partial esophagectomy and gastrostomy as the operation of choice. To relieve pain and dysphagia general sedatives and local anesthetics should be administered.

EDITOR'S ABSTRACT.

FURRED TONGUE IN GENERAL DISEASES. F. KLEE, Monatschr. f. Ohrenh. **68**:129 (Feb.) 1934.

Klee examined the tongues of 434 patients whose underlying disease state had been carefully studied. Furring of the tongue was found in 310 (71 per cent). It occurred in general diseases as well as in those of the oral cavity and could not be considered a specific manifestation in any instance. It occurred in varying degrees in all smokers and tobacco chewers. The author concludes that furring of the tongue allows no conclusions as to the nature of a disease.

EDITOR'S ABSTRACT.

EXPERIMENTAL SCLEROMA. A. I. SMIRNOWA-ZAMKOWA, Monatschr. f. Ohrenh. **68**:168 (Feb.) 1934.

The experiments of Smirnowa-Zamkowa on the infection of animals with Frisch's bacillus were divided into five groups. The first consisted of injecting an emulsion (1 Gm.) of an agar culture of Frisch's bacillus washed off with a physiologic solution of sodium chloride into the nasal mucosa of rabbits. In fifteen instances no chronic process resulted. The second group was similar except that a standard emulsion of Bacillus coli was injected under the skin of the back to lower the general resistance. Again the results were negative. The third group consisted of the injection of an emulsion of Frisch's bacillus into the abdominal cavity, the uterine cavity or the cervical mucosa. Postmortem observations revealed no changes except in the case of the rabbit inoculated in the cervical mucosa. In the fourth group an attempt was made to dry the nasal cavity and reduce the resistance of the animals by injecting intravenously a solution of saccharated ferric oxide. The emulsion injected was subjected to previous animal passage. Histologic examination revealed some inflammatory infiltration of the nasal mucosa with plasma cells, fibroblasts and Mikulicz' cells. The fifth group of experiments differed from the others in that the emulsion of Frisch's bacillus was introduced into the lung tissue. In the animals so inoculated (five) a localized reaction occurred that strongly suggested the presence of scleroma. The author concludes that scleroma is primarily an infectious disease and that Frisch's bacillus is in all probability the specific etiologic agent. In order to apply experimental studies to scleroma the methods of induction have to be varied and the duration of observation must be long.

EDITOR'S ABSTRACT.

DIFFERENTIAL DIAGNOSIS OF ALLEGED HYPOPHYSEAL TUMORS. W. KINDLER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **35**:335 (March 12) 1934.

Kindler describes a case in which the neurologic, ophthalmologic and roentgenologic observations indicated a nonspecific space-limiting process in the neighborhood of the hypophysis. The cerebrospinal fluid showed positive reactions to the Pandy and Nonne tests, without increased cells. The colloidal reaction of Takata and Ara, the Wassermann reaction and the colloidal gold test indicated syphilis. With antisyphilitic treatment the patient's symptoms improved. The condition was therefore considered to be a gumma in the neighborhood of the hypophysis.

EDITOR'S ABSTRACT.

DIABETES AND DENTAL CARIES. H. WEIMAR, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **24**:425, 1933.

In about 93 per cent of forty-five cases of true diabetes investigated by Weimar, dental caries developed or preexisting caries was accelerated. The caries involved especially the necks of the teeth and preponderantly the buccal aspects of the molars and premolars. The front teeth were involved in only a few cases. Parodontitis was present in 71 per cent of the cases. The author feels that it is doubtful that the alterations in the saliva in diabetes are responsible for the caries as well as for the parodontitis and the loosening of the teeth. It seems more likely that some process in the blood is responsible for these changes.

EDITOR'S ABSTRACT.

Society Transactions

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION OF OTOLARYNGOLOGY

WILLIAM S. HEWSON, M.D., *Secretary*

Jan. 17, 1934

INJECTION OF GELATIN INTO THE PERITONSILLAR SPACES (DEMONSTRATION). DR. GEORGE B. WOOD.

In infants infection seems to penetrate the posterior pharyngeal wall and enter the pharyngomaxillary space. In adults this does not occur. In this case an areolar space back of the tonsil is demonstrated and definite faucial planes are shown which prevent the spreading of the injection material anteroposteriorly. The material spreads freely supero-inferiorly.

DISCUSSION

DR. OSCAR V. BATSON: It has always worried me to consider where peritonsillar abscesses might be. In a recent letter Dr. le May of Paris, who was in Philadelphia recently, said that French physicians were working on this problem and that they corroborate Dr. Wood's findings.

DR. GEORGE B. WOOD: Any infection outside of the superior pharyngeal constrictor muscle may produce a phlegmon, but inside of that muscle such a complication is not apt to occur.

CONGENITAL DEFORMITIES OF THE FACE: TYPES FOUND IN A SERIES OF ONE THOUSAND CASES. DR. WARREN B. DAVIS.

In this review of one thousand cases, the varieties of the malformations are classified, the relative frequency of each type is noted and a brief embryologic consideration is given.

In most cases, the congenital deformities resulted from partial or complete failure of union between two or more of the processes which enter into the formation of the face. In other instances, union had occurred but some of the facial processes were malposed or maldeveloped. In occasional cases an embryologic explanation of the development was difficult or even impossible. In such cases the malformations may have resulted from abnormalities in the germ cells themselves, from amniotic conditions producing abnormal pressure or from the formation of amniotic bands or adhesions.

The definite causes of failure of union between the various processes are not fully understood, but certainly, whatever the underlying etiologic factors are, there is a marked hereditary tendency. In this series, more than 54 per cent of the patients with clefts of the lip or palate or of both gave positive family histories of a hereditary tendency. In many instances the family history as obtained was not accurate further back than one generation. If detailed family histories for three or four generations could be uniformly obtained, I am sure that the number of persons showing a hereditary tendency would be well above the 54 per cent. In numerous cases Wassermann tests of the blood were made on the parents and on the patient, but syphilis was not found to be an etiologic factor in the cleft deformities.

Malformations have been attributed by parents to maternal impressions, such as fright, extraction of the mother's teeth or seeing a person with some facial

deformity. In no case, however, has the evidence been worthy of scientific consideration as having any possible etiologic influence, since in every instance the alleged impression occurred later than the tenth week of embryonic life, by which time the processes should have been definitely united.

Race has an important bearing. Clefts of the lip or palate are rare in the Negro, and my associates and I have found these deformities less frequently in Hebrews than in other divisions of the white race.

In every case of a median cleft of the lip in this series, the premaxilla was absent.

In submucous clefts of the hard palate, there was a deficiency in the bony palate, but the mucosal covering was present. Varying degrees of cleft in the uvula or in the soft palate are sometimes associated with this malformation.

Atresia of the anterior nares may be due to organization instead of resorption of the primary epithelial plugs which fill the primitive nasal fossae, or some form of local pressure may be a factor. In each case the obstruction extended to a point approximately represented by the junction of the anterior and middle thirds of the lower turbinate. The posterior portions of the nasal cavities were normal in each case.

"Atresia of the choanae," according to Dr. J. Parsons Schaeffer, would result "should the primitive choanae just dorsal to the primitive palate not form during the process of development; the epithelial lining of the primitive nasal fossae and the epithelial lining of the primitive oral cavity would remain intact, each separated from the other by the thinned-out mesenchymal floor of the early nasal fossae. If the amount of mesenchyme between the pharyngeal and nasal epithelia should remain thick, an osseous atresia would ultimately be formed."

Absence of the nasolacrimal ducts may be the result of failure of the naso-optic fissure to close, or an abnormal closure of the cleft may prevent the formation of the cord of epithelial cells normally formed in the floor of the fissure.

Coloboma results from the incomplete closure of the embryonic choroid fissure; it may be limited to the iris and choroid or may extend into the eyelids or even into the facial clefts.

Congenital mucous pits in the lower lip are always symmetrically placed, one on each side, approximately in front of the lateral incisor teeth. They are usually associated with bilateral cleft lip. Sir Arthur Keith finds that the best explanation he can give for the occurrence of such pits is that they may be a possible reversion to the mucous glands which are normally found in the lip of the shark.

Hemangioma may be of the telangiectatic or of the cavernous form, and it has been thought to be a congenital displacement.

Lymphangioma is analogous to hemangioma, but the growth is composed of spaces and channels containing lymph instead of blood.

The two cases of dermoid cysts of the dorsum nasi each presented a fistulous tract opening just above the lower ends of the nasal bones and containing hair and sebaceous material.

The case of frontonasal depression was due to a meningocele which was obliterated before birth. In the correction of this deformity a cartilage transplant was used to fill up the depression.

Microtia and atresia of the external auditory canal are usually associated. Malformations of the middle ear are sometimes present, as well as malformations arising from more distant portions of the first or second branchial arch, such as clefts in the lip or the palate.

In macrotia the deformity is usually exaggerated by obliteration of the anthelix fold and varying degrees of prolapse.

Rudimentary mandible with microglossia was found in two cases. In a third case there was also a cleft of the palate to the premaxilla.

Cyclopia results from abnormal development of the anterior portion of the brain and faulty separation of the optic vesicles. The large central eyeball with a single large pupil lies in the region of the root of the nose.

In the case of ethmocephalus with anophthalmia there were two rudimentary orbits with a conjunctival lining but no eyeballs. Although the opening in the snoutlike appendage was small, it was patulous.

Anophthalmia occurs most frequently in nonviable monsters. It has been regarded as a complication of hydrocephalus. The patient in this series, 5 years old, presented evidence of arrested hydrocephalus.

A case of hemicephalus, median cleft lip, absence of the premaxilla, rudimentary nasal bones and spina bifida was observed. Whether the arrested development in this case was due to primary defects in the germ cells or to causes acting from without, such as amniotic deformities, is uncertain. The apelike appearance was striking and suggested atavism.

DISCUSSION

DR. A. L. WRIGHT: I was impressed by the enormous amount of work necessary for this presentation. Dr. Stout and I had a patient on whom we did a Brophy rhinoplasty. Brophy believed that clefts occur in embryonic tissue. I should hardly believe this if I had not seen one of identical twins who had clefts of the palate. One placenta existed in this case.

DR. J. A. BABBITT: I wonder whether any observation was made as to whether in cases of cleft palate fluid is more easily forced up the eustachian tube, predisposing to disease of the middle ear. Might not this series reported by Dr. Davis be favorable for establishing Wittmaack's theory of the sclerotic mastoid?

DR. WARREN B. DAVIS: Answering Dr. Wright, Brophy's idea in explaining these clefts is not now held except by Dr. Sherer of Omaha. It seems erroneous to suppose that all the tissue is predesignated in the embryonic stage. In regard to Dr. Babbitt's discussion, patients with cleft palate are decidedly more subject to abscesses of the ear and infection of the upper respiratory tract generally than other patients. His last suggestion indicates work that might be of distinct advantage, but since starting this series I have found so much that would be of profit to study that I have not been able to accomplish it all.

WHY OTOLARYNGOLOGISTS FREQUENTLY FAIL TO REMOVE A FOCUS OF INFECTION. DR. MYER SOLIS-COHEN.

The impression that the otolaryngologist can remove a focus of infection is based on the common misconception which concentrates attention on infected tissue rather than on the infecting bacteria. Removal of foci of infection too often means removal of infected tissue with the infecting organisms still remaining in the adjacent tissue, continuing to live, multiply and elaborate toxins. Recovery occurs only when the infecting germs and their toxic products have been overcome by the patient's defensive forces.

The presence, or even predominance, of a micro-organism in an infected tissue or secretion is no indication of an etiologic relationship. Yet it is from such organisms that most autogenous vaccines are made. The chief objection, therefore, to the use of ordinary autogenous vaccine in subacute and chronic infection is that it frequently fails to contain the infecting germ, it seldom contains its soluble toxins and it often has feeble antigenic power.

The pathogen-selective culture, which is simple and easily available for clinical use, furnishes a means for selecting the etiologically important organisms from a mixed culture. The pathogen-selective vaccine consists of a broth culture of these germs and contains the soluble exotoxins as well as the endotoxins elaborated during their growth.

Owing to its extremely high potency, the pathogen-selective vaccine must be administered with the greatest caution. The dose may have to be as low as one ten-billionth of a cubic centimeter of a suspension containing one billion organisms in a cubic centimeter. With its skilful administration, supplementing the work of the otolaryngologist, it is possible in many instances to eradicate the primary focus of infection.

DISCUSSION

DR. H. P. SCHENK: I agree with most of what Dr. Solis-Cohen has said, but have some difference of opinion as to stock vaccine, particularly in the treatment of the common cold. I believe, however, that vaccine which was made in the Chicago area may not be useful in the Philadelphia area. One probably often deals with secondary invaders which may change with successive colds. I believe that if cultures of these organisms are well mixed, stock vaccine from them is useful. I think that Dr. Solis-Cohen is right about exotoxin. Intradermal tests are useful, not for finding a focus but for determining the allergen.

DR. PHILIP STOUT: I suppose that with the use of new air-conditioning equipment there will be more control of these infections. Hypersensitiveness is a condition that all otolaryngologists must take into consideration. Even mold floats in the air and may give rise to some of these conditions. I believe that after removal of the plain focus the patient is apt to be improved though residual infection remains. Stock vaccine which is given while fresh gives better results, and I think that it should be used in the first two weeks after it has been made.

DR. KARL M. HOUSER: I am impressed by the high dilutions used by Dr. Solis-Cohen and should like to ask in what type of cases such high dilutions are necessary. Are the cases allergic? And is there any difference in the reactions to the bouillon with or without bacteria?

DR. MYER SOLIS-COHEN: I was particular to exclude acute infections and prophylaxis in this paper. I believe that stock vaccine is better than the ordinary autogenous vaccine, the latter being practically useless. In acute infections, stock vaccine is about as good as any other. What is often called a common cold may be an exacerbation of a latent infection, and to induce recovery in such a case it is necessary to get rid of the bacteria. I believe I have shown that toxin of any organism produces skin reactions which are different from those caused by the organisms affecting the patient. Answering the question about the type of cases requiring very minute doses, I think of a dentist with arthritis who was helped after his fifth dose, beginning with only 15 organisms. In the case of another patient one trillionth of a cubic centimeter of a suspension gave results.

CONGENITAL MULTIPLE HEMORRHAGIC TELANGIECTASIA WITH EPISTAXIS. DR. KARL M. HOUSER.

Since Rendu in 1896 and Osler in 1901 called attention to the association of multiple telangiectases with familial epistaxis, the condition is sometimes called "Rendu-Osler's disease." In the past few years, however, the names of other authors have been associated; so for the sake of simplicity it seems best to refer to the disease by the descriptive title of "congenital multiple telangiectasia."

The disease is well known to the internist and hematologist, and most of the literature on it has appeared in journals other than those devoted to rhinology. The latest comprehensive review of the subject, by Hurst and Plummer, in January 1932, reported that the literature up to that time included fifty-seven family trees showing indisputable evidence of the disease.

The family tree here reported illustrates the condition rather typically. A history of severe epistaxis runs through four generations. I treated four patients in this group. One of these died from nasal hemorrhage, and three other members of the family were said to have died from the same cause.

Males and females may both be affected and transmit the disease, whereas in the case of hemophilia females are rarely if ever affected, yet almost always are the transmitters. The changes in the blood in multiple hemorrhagic telangiectasia are none other than those dependent on the degree of secondary anemia. There is no tendency to bleed readily from cuts, the hemorrhage always occurring from one or more of the telangiectases which must be present to allow the case to be properly classified.

According to Larrabee and Littman, three postulates must be fulfilled before the diagnosis can be made: 1. There must be a history of heredity. 2. There

must be visible nevi distinctly pathologic in numbers and distribution. 3. There must be a tendency to bleed from such lesions.

The telangiectatic lesions are similar to those frequently seen in normal persons. Usually they are small red or purple spots on the nasal mucosa of both the septum and the turbinates, and sometimes on the oral mucosa. The external distribution may vary, and many, few or none may be found. They may be distinguished from purpura in that they disappear on pressure. Bleeding occurs from any of the lesions but is most common from those of the nasal mucosa. Epistaxis usually calls attention to the disease.

Microscopic examination of these nevi shows extreme thinness of the vessel walls. A single layer of endothelial cells is covered by a greatly thinned epithelium.

Death from epistaxis is relatively rare, the mortality being approximately 4 per cent. The hemorrhages tend to increase in severity and frequency toward middle age, and if not checked lead to moderate or marked secondary anemia. Hence, many patients, although not dying from the disease, die from conditions induced by the constant hemorrhage.

In three of my cases cauterization of the lesions with chromic acid was rather effectual. This supports the mechanistic theory that if the nevi are destroyed the bleeding ceases. In one case, no matter how thoroughly the lesions were destroyed, new ones formed in the adjacent mucosa in a relatively short time. The new nevi showed just as much tendency to bleed as the old ones. It was this case in which fatal hemorrhage occurred. Radium, roentgen radiation, electrocoagulation and galvanocautery have not given as good results, in my experience, as the chromic acid bead. Trichloracetic acid does not seem to form enough scar tissue to give permanent results.

Hurst and Plummer suggested a simple device by which the patient himself can control the bleeding. A soft rubber catheter is passed into a rubber finger stall, and the neck of the stall tied tightly around the catheter, not enough to occlude the lumen. The rubber bag is dipped into oil, introduced into the nose and then inflated, and pressure is maintained for ten or fifteen minutes. Deflation is performed slowly, and the bag is allowed to remain in place for a few minutes. This procedure, which is a modification of the Cooper-Rose inflation plug method can be repeated as often as necessary.

Fitz-Hugh calls attention to the increasing intolerance to blood transfusions in this disease, especially when there is splenic and hepatic enlargement in a person whose blood is of type IV. Therefore, it is wise to consider the case carefully before resorting to transfusions.

Case 1.—A 35 year old man had a history of profuse epistaxis occurring once in six or eight weeks, lasting for several days at a time. Several nevi were found on the antero-inferior portion of the nasal septum, but none elsewhere. Several cauterizations with chromic acid resulted in absence of hemorrhage for three and one-half years.

Case 2.—The mother of the first patient, 58 years old, had suffered from repeated nasal hemorrhages since childhood. Treatment of many kinds had been used, including radium, roentgen radiation, electrocoagulation, thermal cautery and blood transfusion. Her nose showed many nevi in both nostrils, on the septum and turbinates anteriorly. These lesions bled profusely on the slightest manipulation. In addition to the nasal nevi numerous telangiectases were present on the lips and on the skin of the face, hands and neck. The spleen and liver were enlarged and palpable. The patient reacted badly to blood transfusion, jaundice developing following this procedure. General treatment consisted of an anti-anemic diet and high voltage roentgen therapy of the spleen. Locally, chromic acid cauterization was used and for a time seemed to control the condition. New lesions developed adjacent to and in the treated areas. She became discouraged and failed to return, and died from nasal hemorrhage about a year ago.

Case 3.—A boy, 6 years old, the grandchild of the second patient and the son of the first patient, had occasional nasal hemorrhages and in March 1929 showed

several nevi on the nasal septum. Several cauterizations with chromic acid have completely controlled the epistaxis to the present time.

CASE 4.—A cousin of the second patient and an uncle of the third patient had typical nevi on the nasal septum and several on the anterior ends of the middle turbinates. A few nevi were present on the ventral surface of the tongue. He had had bleeding from early childhood. On examination in August 1933, he showed profound secondary anemia, emaciation, weakness, pallor and splenomegalia. Transfusion was not given. Instead, a high vitamin, anti-anemic diet with iron by mouth and liver extract intravenously was administered. Local treatment consisted of chromic acid cauterization of the lesion and finally resulted in complete stoppage of the epistaxis.

Since that time there has been no hemorrhage other than an occasional blood streak.

DISCUSSION

DR. ROBERT HUNTER: I cannot make any observation as to the frequency with which new lesions appear. Goldstein wrote of this condition and called attention to the susceptibility of patients of middle age. I have seen three cases. The lesions were located in the throat, lips and chest as well as in the nose, and the bleeding was always from areas on the nasal septum. Various methods of treatment were used without great success. It seems rational that punching out the areas would help, because of the low clotting time of blood from these regions. One case of mine died of a nasal hemorrhage. Radium treatment seems to be helping another patient. One never knows when other spots may occur.

DR. KARL M. HOUSER: I should like to know what results will be shown by Dr. Hunter's patient who is being treated with radium. In one of the cases that I reported this form of treatment was given.

WILLIAM S. HEWSON, M.D., *Secretary*

Feb. 21, 1934

A METHOD OF PLASTIC FLAP CLOSURE OF A FISTULOUS WOUND RESULTING FROM AN OPERATION ON THE MASTOID (PRESENTATION OF A CASE). DR. JAMES A. BABBITT.

This patient is one of two on whom this method was used. When first seen, at the age of 23, he had a depressed wound left by removal of the left mastoid and a fistulous tract through which the eustachian tube was curretted. He had paralysis of the seventh nerve of the left side and had been deaf in that ear since mastoidectomy at 1 year of age. Under avertin and ether anesthesia, the Almour plastic procedure was applied, by which a pedicled flap, consisting of skin, temporal muscle and periosteum, was inverted into the wound. Scar tissue was removed, the edges of the wound were undermined and the fibrosed posterior auricular wall was removed in order to produce complete radical drainage. A drainage tube was inserted through the auricular opening into the mastoid cavity, and the edges of the wound were sutured. The patient made a good recovery with slight scarring and practically no depression. Since the operation, moreover, he has been regaining power in his left cheek, and there has been improvement in hearing.

DISCUSSION

DR. GEORGE M. COATES: Did Dr. Babbitt clean up the cavity left by mastoidectomy in the course of his operation?

DR. JAMES A. BABBITT: The cavity was cleaned up, the adhesions were removed and the edges of the wound were undermined.

DR. PHILIP STOUT: I think that the recovery from the facial nerve paralysis was due to the cleaning up about the severed part of the nerve.

DR. JAMES A. BABBITT: The purpose of this presentation was to show complete filling in of a depressed wound left by mastoidectomy by this method of muscle flap closure. The question of restored innervation is entirely a side issue.

DR. WARREN DAVIS: Revitalization of the facial nerve in this case may have been brought about by the introduction of the strip of temporal muscle into the wound.

INCIDENCE AND SIGNIFICANCE OF SINUSITIS IN PNEUMONIA. DR. EDWARD H. CAMPBELL.

This article will be published in full in a later issue of the ARCHIVES.

DISCUSSION

DR. WARREN B. DAVIS: This report of Dr. Campbell's is interesting. The association of sinus infection with pneumonia is further borne out by many postmortem examinations. A large percentage of patients dying of pneumonia show involvement of the sinuses also. The prevalence of sinus disease in early life is illustrated by a patient 8 days of age whom I saw, whose antrum was so diseased that before death there was perforation through the anterior bony wall.

DR. S. R. SKILLERN: Dr. Campbell has presented an interesting paper on which he must have spent many hours of tedious work. How, in spite of the use of 2 per cent cocaine solution to shrink the nose, he prevented the windows in his nasopharyngoscope from being smeared. His differential diagnosis of maxillary from anterior ethmoid infection is especially interesting, as he states that it is based on seeing the secretion in or hanging from the normal maxillary ostium. I have never attempted to find the normal maxillary ostium in an infant, as I always considered it an impossibility, so I cannot say that it cannot be seen; but I have tried on numerous occasions to find the ostium in adult patients, and the best I have ever accomplished was to find an accessory ostium below the overhanging middle turbinate.

DR. GEORGE M. COATES: I wish to compliment Dr. Campbell for the painstaking examinations that were necessary. I have been impressed by the association of these conditions since my observations in 1918 in the army, where the mortality was high. I followed many patients through the illness, and few had no pus in the sinuses and ears.

DR. R. PARRISH: Was any bacterial study made in this series or any typing of the cases of pneumonia done?

DR. PHILIP STOUT: The mammals in the zoo and the larger domestic animals, which necessarily have small sinus ostia, are more apt to contract pneumonia. No mention was made of transillumination; I should think this would be helpful.

DR. EDWARD H. CAMPBELL: Referring to Dr. Skillern's question, I think that one can often see the maxillary ostium. I frequently have to remove secretion from the nasoscope. Pus may hang from the maxillary ostium, and if I see pus higher up I assume that inflammation of the ethmoid sinus exists as well. Answering Dr. Parrish, I did not make bacterial studies in these cases as it was too hard to make reliable cultures from the sinuses as well as from the lungs. As to Dr. Stout's suggestion about transillumination, this examination also is not reliable except in older children.

PRIMARY JUGULAR BULB THROMBOSIS IN THE ADULT. DR. HENRY DINTENFASS.

This article will be published in full in a later issue of the ARCHIVES.

DISCUSSION

DR. S. DANA WEEDER: In the case referred to which Dr. Bates and I observed about eight or nine years ago, the patient had a spontaneous rupture

of the drum and no discharge from the ear. The temperature was 101.6 F., and the pain was not over the mastoid but in the neck, suggesting a Bezold abscess. For this reason, mastoidectomy was done. The mastoid was found normal, but pus was obtained from the mastoid antrum. The lateral sinus appeared normal, but the fever continued, and a blood culture showed Streptococcus haemolyticus. The jugular vein was then tied, after great difficulty in finding it, for nature had closed it off. Free bleeding was obtained from the sinus above. Fever and chills continued, and pain developed in the right knee and sacro-iliac joints. Culture from the joints showed Streptococcus haemolyticus. Dr. Bates did a Wiems operation, opening the knee joint widely. This led to complete recovery.

Dr. George B. Wood: I had one patient 7 years of age at the Howard Hospital. The temperature ranged between 103 and 104 F. There was slight discharge from the ear, though incision of the drum gave a dry tap. The temperature increased but was not "steeplechased." The mastoid was opened and found to be sclerotic. The lateral sinus was exposed and appeared white. Incision of the sinus yielded free pus.

Dr. David N. Husik: I had a 7 year old patient with purulent otitis media which was cured in two weeks. He returned to school, and after one week headache and pain developed in the same ear. High temperature was accompanied by chills and perspiration, which continued for one week. He was sent to the hospital for study. Examination of the ears gave entirely negative results. The temperature rose to 105 F. He was seen by an internist, Dr. Riesman, and the diagnosis of septicemia was made. Pregl's solution was used. The intake of liquids was forced, and other routine measures were employed, and in three weeks the patient got well, though pericarditis with effusion developed. I believe that this boy had thrombosis of the jugular bulb.

Dr. Walter Roberts: About Dr. Dintenfass' case my associates and I were very much in doubt. To make a diagnosis in such cases is difficult enough, but it is often even harder to decide when to operate and when not to.

Dr. Philip S. Stout: One should be careful about the use of the term "primary" in cases of such infections. Dr. Gleason says that he has never seen a primary infection of the bulb, and I believe the condition is extremely rare.

Dr. Henry Dintenfass: I remember Dr. Weeder's case well, and it was exceedingly interesting. In reference to Dr. Stout's comment, the etiology in these cases can be determined only by the appearance of the clot and the condition of the inner side of the sinus wall at the time of operation as indicating just where the thrombus started.

Mucocele of the Right Frontal Sinus. Dr. Robert J. Hunter.

Frank Williams, a Negro aged 53, was admitted to the Philadelphia General Hospital on Dec. 5, 1933, with a large, hemispheric, painless swelling of the forehead above the right eye. It extended from the junction of the outer and middle thirds of the right supra-orbital ridge across the midline just above the base of the nose. The patient stated that the condition had begun fourteen months before with intense pain localized just above the right eye. There was no vomiting or disturbance of vision. The pain ceased in eighteen days. Twenty-one days later he noticed a swelling in the right supra-orbital region above the ridge and over the midline. Twelve months before the onset of pain he was hit above the right eye with a stevedore's hook.

At the vertex of the skull was another hemispheric swelling about 1 inch (2.5 cm.) in diameter. This growth was not of hard tissue but was firm. The skin over the growth was slightly movable.

The larger mass over the frontal area gave the impression of a rather tense cyst. There was no tenderness on palpation, fluctuation or inflammatory signs. It did not transmit light. It was not nodular, but was regular in outline, like a slow-growing sac.

Dr. Wilson found that the patient had no neurologic signs. The Wassermann reaction of the blood was reported positive, and the man was given active antisyphilitic treatment. Dr. Cowan reported that vision, ocular movement, the position of the eyeballs and the eyegrounds were normal.

Dr. Righter made a tentative diagnosis of dermoid cyst, which was supported by the fact that the mass appeared to be cystic, that it was in a position on the brow where such cysts are frequently seen, i. e., at the inner canthus, at the site of a branchial cleft in embryonal life, that it followed trauma and that the skin was movable over it.

The report of the roentgen examination was as follows: "Density is seen in both antrums and in the ethmoid and sphenoid sinuses. There is a soft tissue tumor in the supra-orbital region on the right side, and a large bony defect of the frontal bone is apparent in the region of the right frontal sinus. The diagnosis was chronic pansinusitis. There probably was surgical removal of bone because of the frontal sinus infection. The soft tissue tumor may be due to prolapse of the meninges."

Meningioma with erosion was considered, but in that condition the bone usually shows greater density than was presented by this patient. Meningocele and encephalocele were ruled out by the fact that the history indicated a recent origin and that the tumor was not compressible. Osteoma was ruled out by lack of density in the x-ray picture.

Antisyphilitic treatment having had no effect, a diagnosis of a possible dermoid cyst was made. At operation a large quantity of thick, opalescent fluid like boiled starch was removed, which was sterile and on chemical examination contained mucin. A large frontal sinus was found, with the entire frontal plate eroded except a small margin. In the posterior wall of the sinus were two circular eroded areas near the outer canthus. Here the dura was exposed. The eroded edges of the bone were smooth and rounded. The sinus extended well over the middle line of the forehead. No definite nasofrontal duct could be found, although in the appropriate place three small punctate areas were seen. The fact that the cavity was not globular but had the contour of a frontal sinus and that the laboratory reported that no cholesterol was found, plus the demonstration of cilia in the lining mucous membrane, clinched the diagnosis of mucocele of the frontal sinus. With the exception of the intranasal part, nature had performed a radical Killian operation including removal of the bridge. The orbital plate of the frontal sinus was not involved. The mucous membrane of the sinus was very thin and did not look diseased. The two perforations of the posterior plate suggested a healed syphilitic osteomyelitis, but pressure of the mucocele was sufficient to explain them.

The literature mentions several cases of mucoceles beginning in an abrupt manner, erosion of the frontal plate being much less frequent than that of the orbital plate of the frontal sinus with displacement of the eye downward and outward; such cases frequently begin several years after an injury.

The finding of large anterior ethmoid cells placed well forward in this case conforms with the opinion of Howarth that this is a causative factor in mucocele. He was of the opinion that these cells were injured by trauma and that the duct, owing to its unusual position, is much narrowed and also subject to injury by trauma, resulting in stenosis.

The tumor on the vertex proved on operation to be a lipoma.

The extensive bone absorption found in cases of mucocele, with an inflammatory deposit of calcium salts in the edge of the defect in some cases and absorption in others, makes the diagnosis of mucocele by roentgen examination extremely difficult.

(Dr. Ostrum demonstrated the x-ray pictures of the case.)

DISCUSSION

Dr. David N. Husik: I inherited this case in the change of services and so had charge of the after-treatment. Since contact with this case I understand

that mucocele is unusual and that it may attain a large size. Needle puncture can often differentiate it from other growths.

DR. RALPH BUTLER: Many years ago I observed a young man who was kicked in the face. A mucocele developed, and as was the established treatment then, a gold tube was inserted. Being rather ignorant, the patient did not continue the treatment and died several years later of meningitis.

DR. ROBERT J. HUNTER: Since this was my first case of this condition, I did not realize that it was so rare until I looked it up in the literature. Among Dr. Pfahler's twelve thousand slides, there was not one of mucocele. In the Graduate Hospital collection I found one case of mucocele of the maxillary sinus, which is even rarer than mucocele of the frontal sinus. This mucocele transilluminated clearly. Dr. Pancoast says that he has no record of a case. So I believe the condition is rare. This man had some pain for the first few days only.

AN AURAL PROBLEM. DR. WALTER ROBERTS.

During the many years of the operation of otologic services in the Methodist and Polyclinic Hospitals, in no class of cases has the feeling of uncertainty been more evident than in some of those of suppurating ears, acute or chronic, in which suddenly or periodically there developed high septic temperatures. Every aurist immediately has a mental picture of an infected lateral sinus, and he has been taught that the sooner he intervenes operatively and relieves the condition, the better is the patient's chance of recovery. But for the purpose of presenting another side of the picture and showing how easily one may be misled, the following cases are reported.

CASE 1.—A child, 4 or 5 years old, was suffering from an acute attack of bilateral aural suppuration. She seemed to be doing well when suddenly, without any apparent reason, she began to have a high septic temperature. Every day the temperature would rise to about 105 F. and in a few hours return to normal. She had no severe chills, although she did complain of chilly feelings. She was removed to the Methodist Hospital for laboratory examination and any operation that seemed to be indicated. Experience has taught that nearly all sinus infections are streptococcic, and as both ears were affected there was a problem of deciding which side was the focus.

Being desirous of sharing the responsibility, Dr. B. A. Randall saw the patient and finally gave the opinion that the sinuses were not yet involved, that the usual local symptoms were lacking and that the septic temperature might be due to some other condition. He advised a course of treatment with mild mercurous chloride, followed by magnesium citrate solution two hours later and by 1 fluidounce (30 cc.) of a 5 per cent solution of sodium bicarbonate by rectum at bedtime. The result of the treatment was a revelation. The temperature did not rise again, and the child returned to her home within a week. Evidently the hyperpyrexia was due to acidosis. Many times since then the same success has been achieved in children. Again and again the septic temperature has disappeared so quickly that it seemed miraculous. That I may not be misunderstood, however, let me emphasize that if the sinuses are really involved, treatment for acidosis will not benefit the patient though it will do no harm.

To illustrate the difficulties of correct diagnosis and to show how unnecessary operations on these children with alarming symptoms may be avoided, three of the cases observed during the past year are reviewed.

CASE 2.—A girl of 22 months with lobar pneumonia and bilateral otitis media had a very high temperature for the first week (106 F.), which dropped to normal for a few hours, only to be followed by a very high, septic temperature for another week. As she presented no symptoms of mastoiditis, the blood did not contain a high percentage of polymorphonuclears, there was no infiltration or glandular swelling at the angle of the jaw and the discharge from the ear yielded pure cultures of pneumococci instead of streptococci, operation was advised against. The temperature after about ten days of wild behavior fell by crisis to normal,

and the child made a perfect recovery. It would have been much easier to have bared and examined the sinuses. The true explanation of the unusual symptoms is in Dr. Percival's roentgenologic report: "An abscess has occurred in the upper lobe of the right lung which is being gradually absorbed."

CASE 3.—A baby of 20 months presented a condition diagnosed as bilateral otitis media and bronchopneumonia. He had had a cold, running ears and remittent fever for about a month before admission to the hospital. For the following eight days he had a septic temperature, which rose to 105 or 106 F. every evening and dropped in a few hours to about 97 F. Although there were enough pathologic changes in the chest to account for the high fever the chart was so characteristic of a sinus infection that the presence of hemolytic streptococci in the discharge from the ear gave one a feeling of uncertainty. Eleven days after admission the temperature became normal, and it remained so until the child was discharged.

CASE 4.—A girl of 4½ years had been ill for seven weeks prior to admission to the hospital. For about two weeks before admission she had severe chills daily, followed by a high fever. She looked ill, had a septic appearance and had lost weight. Her left ear had been discharging for several weeks, but the discharge had ceased. A blood culture showed hemolytic streptococci, and the outlook was serious. The ear had apparently cleared, but very unhealthy tonsils and seven abscessed teeth were found. Immediate extraction of the diseased teeth was followed within forty-eight hours by a marked improvement. The temperature promptly came down to normal and stayed there. Another blood culture showed hemolytic streptococci. Adenoids were found, and they and the tonsils were removed. Recovery then seemed to be complete. Dr. Diven was asked what should be done about the blood culture, but he said to "forget it," for the child was well.

DISCUSSION

DR. GEORGE M. COATES: It is a great pleasure to hear Dr. Roberts read a paper again. I recall once, after a staff meeting at the Graduate Hospital, telling him of a difficult case in which I had recently operated. The temperature was "steeplechase." In accounting for it one took into consideration lateral sinus infection. Dr. Roberts advised the administration of mild mercurous chloride and sodium bicarbonate, and I had the satisfaction of seeing this patient and a number of others with similar conditions recover entirely without operative intervention.

DR. KARL M. HOUSER: I remember a case in which a patient who showed these alarming symptoms was about to be operated on but roentgen examination of the chest was reported to show evidence of pneumonia and so the condition was explained.

DR. WALTER ROBERTS: I feel that one has never lost anything by watchful waiting. The late Dr. S. Macuen Smith said, in the last year of his life: "If you can wait until a barrier is formed around the infection the result is better. Be sure you are right, as nearly as you can, then go ahead."

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